48,105

James Lamesor

A

TREATISE

ON

INDIGO,

CONTAINING

A SUCCINCT ACCOUNT OF THE PROPER SOIL, THE CULTURE AND PREPARATION OF THAT IMPORTANT ARTICLE OF COMMERCE; TOGETHER WITH THE THEORY AND PRACTICE OF THE PREPARATION.

THE DIFFERENT SPECIES AND QUALITIES OF INDIGO, AND OF THE ACCIDENTS TO WHICH IT IS LIABLE FROM THE SOWING OF THE SEEDS UNTIL THE CROP, AND DURING THE PROCESS OF THE MANUFACTURE,

&c. &c. &c.

TRANSLATED FROM THE FRENCH

BY

RICHARD NOWLAND.

CALCUTTA:

PRINTED BY JAMES WHITE.

M.DCC.XCIV.

PATENT OFFICE
LIBRARY.

BRITISH MUSEUM
16 69
OCT

TO

THE INDIGO PLANTERS AND MANUFACTURERS OF

BENGAL,

THIS TRANSLATION

OF A

TREATISE ON THE MANUFACTURE

OF

INDIGO,

IS

HUMBLY INSCRIBED.

PATENT OFFICE LIBRARY

PREFACE.

23.6.13.

DURING theſe laſt fifteen years, no people perhaps have afforded a more ſtriking example of the rapid and happy reſult of induſtry and enterprize, than the Britiſh Inhabitants of the Engliſh Eaſt India Company's poſſeſſions in Aſia; under the auſpices of a Government, ever ready to encourage uſeful undertakings and promote induſtry, various improvements have been made in manufactures, in agriculture, and commerce encreaſed: but more eſpecially in the culture and manufacture of Indigo in Bengal, which will no doubt be ultimately carried on to an extent and perfection not inferior to that of any other part of the world.

MANY writers have unſucceſsfully attempted to trace the origin of making Indigo; it appears however by the teſtimony of them all, that it was well known in Aſia for ages paſt, and what conſtitutes the fact is, that the matter was formerly tranſported to Europe by the Red ſea, and was ſuppoſed to be a ſtone indigenous to the country, and called the *Indic ſtone*.

IT is confirmed alſo by the ſame authors, that before thoſe times, Indigo was alſo made in Arabia, in Egypt, and even in the Iſland of Malta; but as theſe laſt concealed the art of manufacturing it, all the Indigo which was conſumed in Europe, was reputed to come from India; in ſhort they conceive and with great probability that the ancient Mexicans alſo, were well verſed in this art in which they had been taught by the CASTILLIANS who returned thither from the MOLUCCAS.

I INTEND by no means to enter into the diffuſed opinion of authors upon the origin of the manufacture; I will here ſtop and briefly ſtate the contents of this book and offer a few introductory remarks, which perhaps may not be thought altogether unneceſſary.

IN this work I have made ſuch extracts from the different authors, concerning the planting, cutting, ſteeping and beating the Indigo herb, as obſerved in different countries, but more particularly in the Weſt Indies, as I conſidered beſt ſuited for inſtructing the young practitioner, and I hope in ſuch manner as will render the practice eaſy to him; I am ſenſible that ſome of the deſcriptions are nearly alike, but as each of them have ſome peculiar points worthy of obſervation in the courſe of the proceſs, I did not think myſelf authoriſed to retrench from the books I had before me.

ADVERTING to the introduction to the tranſlation of "*Mr. de Coſſigny de Palma's Memoir, containing a treatiſe on the cultivation, &c. of Indigo,*" publiſhed in Calcutta in 1789, I find it advanced, *that ſeveral perſons concerned in it, are "only under the guidance of the Indians;*" but although I doubt not ſince that period many of the proprietors of manufactories have provided themſelves with uſeful works from Europe treating upon the art, I did not think my labour ill employed by offering them a tranſlation of Mr. de Beauvais Roſeau, and other authors, in which even the experienced artiſt may diſcover information: for this art above all others is the moſt unfixed and of the moſt doubtful iſſue in the proceſs.

THE reader can compare the various methods practiſed in different countries, and he will find that the proceſs of the Indians, is the ſimpleſt; and it has been hitherto allowed that their Indigo in general is preferable to any other. In point of accuracy it ſeems, that the European practice is the beſt, but how far I ſhould be juſtified in hazarding that opinion, as fact, is ſubmitted to the European manufacturers in this country.

THE

The Indians affix no regulated time for the duration either of the fermentation or the agitation; nor do they trouble themſelves about the nature of the ground upon which the herb had grown, nor the quality of it, and yet they do not fail of ſucceſs as to the general quality of their Indigo: on the contrary our artiſts, after pointing out the influence which the ſeaſons have upon the herb, of the conſequence it is to obſerve the quality of it, and the requiſite time for the duration of the proceſſes of fermentation and beating, the ſigns by which we are to be guided, they ſtill tell us, that we may fail and we find it to be too true. Profeſſor Ludovici obſerves, that although Indigo has been made for ages paſt, and that every experiment which ſcience can ſuggeſt has been tried to aſcertain the method of making Indigo, for certainty, of the beſt quality, yet the ſecret has never been diſcovered; a circumſtance, which would moſt aſſuredly diſcourage the artiſt, if the value of the various qualities which chance or experiment produce, did not amply recompenſe him for his labour.

The different proceſſes of which this work treats, and the attentions to be paid, are fully particularized. I had wiſhed to have been able to furniſh engraved plates for the the 7th Chapter, but many circumſtances have oppoſed this inclination.

If, in this effort to bring forward a tranſlation of the art of manufacturing a commodity now in ſo high eſteem in this country, I have been inaccurate, it has not proceeded from a want of attention, but that of the neceſſary ability, and a knowledge of the Art.

I can aſſure my reader, that this is the firſt attempt I ever made at tranſlation, and that every other deſire and reaſon than that of ſeeing my name affixed to a publication, preſſingly urged me to undertake the tranſlation.

Calcutta, 4th June, 1794.

BRITISH MUSEUM
16 69
OCT

PATENT OFFICE LIBRARY

CONTENTS.

THE elements of the Manufacture of Indigo, - - page 5

Of the culture, the ſoil, and the crop fit for Indigo, - - 10

Preparations, and a general deſcription of the handicraft of Indigo, - 14

The practice of the theory of the manufacture of Indigo, Preamble, - 26

Of the fermentation of Indigo, - - - - 30

Of the quality of the herb, how eſſential to guide the manufacturer—Art. 1. - 31

Of the plant that has benefitted from every favourable circumſtance, and the fermentation then requiſite—Art. 2, - - - 37

Ditto, that has greatly ſuffered, and how it is to be managed—Art. 3, - 38

Of the beating or agitation of Indigo, - - - - 40

Of beating an herb that has fermented well—Art. 1, - - 44

Of beating an herb that has not fermented enough—Art. 2, - - 26

Of beating an herb in fine weather, the diſſolution of which having exceeded in one or two hours—Art. 3, - - - - 48

Of the buildings, veſſels and utenſils; precautions to be taken in the diſpoſition of them; and inſtructions about the proceſs, - - - 53

Manner of ſowing, of cultivating and of extracting the colour of the Indigo plant, by Herbert de Jager,—Art. 1, - - - 65

Manner of cultivating and preparing Indigo at Guzzerat, by Baldous—Art. 2, 67

Deſcription of the culture of Indigo, and the manufacture at Sarqueſſe, near Armadabad, by J. A. Mandelſlo—Art. 3, - - - 69

Deſcription of the culture of Indigo, and of its manufacture in Guzzerat, by Van Twiſt—Art. 4. - - - - - 70

Ditto

CONTENTS.

Ditto in China and Agra, by ditto, - - - - 71

Deſcription of the culture and manipulation of Indigo, by Francis Pelſart—Art. 5, 73

Deſcription of the culture and manufacture of Indigo at Carolina, by W. Burke, Art. 6, - - - - - 75

Deſcription of the culture and of the preparation of Indigo in the Eaſt Indies,—Art. 7, - - - - - - 79

Of the manufacture of Indigo in Africa—Art. 8 - - - 81

Of the different ſpecies and qualities of Indigo, and of the accidents to which it is liable from the plantation of the ſeeds until the crop, - - 82

Of the different ſorts of Indigo and how to judge of their quality, by Profeſſor Ludovici, - - - - - 88

Of mucilages, and the uſe of them in the manufacture of Indigo, - 92

Of the alkali uſed in the preparation of Pruſſian blue, recommended as a good precipitant, for ſettling the fecula of the Indigo, - - 94

A further deſcription of the plant called Amonpha, or Baſtard Indigo, - 95

BRITISH MUSEUM
16 69
OCT

ERRATA.

Page 16, line 6, for *cup it* read, *cup is.*
—— — line 7, for *is really* read, *it really.*
—— 17, —— 10, for *furniſh* read, *ſtrengthen.*
—— 21, —— 3, for *period* read, *time.*
—— —— —— 26, after *occaſion* add, *between them.*
—— 23, —— 18, for *vicious* read, *viſcons.*
—— 28, —— 6, after *diſtinguiſhes* add, *them.*
—— 32, —— 17, after *if it is* add, *in.*
—— 33, —— 18, for *does* read *do.*
—— 36, —— 11, for *ſecend* read, *ſecond.*
—— 39, —— 25, for *an influence* read, *influence.*
—— 42, —— 1, read, *it is not uncommon.*
—— — —— 22, for *nerb* read, *herb.*
—— 45, —— 11, for *si* read, *is.*
—— 48, —— 16, for *try* read, *by.*
—— — —— 19, for *ſucceſs* read, *exceſs.*
—— 54, —— 19, for *drought* read, *draught.*
—— 69, —— 10, for *to* read, *or ciſterns.*
—— 71, —— 7, after *ſtem* add, *and the roots.*
—— 72, —— for *cut that* read, *cut aud put it into.*
—— 82, —— 11, for *geneal* read, *general.*
—— 85, —— 12, for *feeded* read, *run to feed.*
—— 87, —— 16, after *The maroon* add, *or another wild Indigo.*

A

TREATISE

ON THE

CULTIVATION and MANUFACTURE

OF

INDIGO.

PATENT OFFICE LIBRARY
23. 6. 13.

CHAPTER I.

The Elements of the Manufacture, by Mr. De BEAUVAIS RASEAU.

THE theory of this Manufacture is founded upon the fermentation of vegetables that are ſubject to paſs from a hot or ſpirituous ſtate, to an acid one, and from this to a putrid ſtate, where they have been for a length of time infuſed in a certain quantity of water.

ACCORDING to theſe principles, Indigo can ſucceſſively go through thoſe three revolutions; but practice teaches us that the ſpirituous kind is alone proper for the Artiſt, becauſe the acid criſis being ſcarcely perceptible, the herb ſeems to paſs ſuddenly from the moſt ſpirituous ſtate, and the beſt indications, to that of putrefaction, which is wholly and ſolely prejudicial to it: and for that reaſon, few if any artiſts, make mention of the acid kind in the proceſs; they only divide the vinous or ſpirituous fermentation into two times or degrees. The firſt degree they call the *imperfect rottenneſs*;

and the ſecond the *good* or *perfect rottenneſs*. As to the putrid or alkaleſcent kind, they call it *exceſſive rottenneſs*, and ſpare no attention nor pains to avoid it:

It is learnt alſo by practice, that, to make the moſt of the extract, it ought to be drawn off from the firſt vat wherein it is mixed with the plant, and then be beat or agitated in order to reduce all the principles proper for the formation of the Indigo, into a ſtate of ſmall diſtinct grains, that drain eaſily in the bags afterwards; which effect is not had with certainty but by the means of beating. For if the extract of a vat is left to itſelf, in expectation of obtaining the fecula or ſediment without the help of beating, it would become putrid; and the imperceptible principles of the grain being conſequently deprived of their neceſſary preparation, would ſettle at the bottom of the vat in a thick ſlimy fluid, which would be incapable of draining dry; on that account the beating or agitation of the extract vat is never delayed, except, when another vat is nearly ready for beating, ſo that both may be agitated at the ſame time, in the ſame vat; or, when it is perceived that the extract drawn off into the beating vat, has not fermented enough, and then time can be allowed to perfect the fermentation. This laſt delay ſhews that the drawing off from the ſteeping vat, doth not operate againſt, nor impede the general courſe of the fermentation of the extract, and the neceſſity of beating it according to the uſual cuſtom. But in this art no preciſe rule is laid down for the time of fermentation, nor for that of beating, becauſe theſe two points eſſentially depend, upon the quality or the ſubſtance of the herb, and that quality, upon the nature of the ſoil in which the herb was produced, and the changes of weather it may have met with during its growth. The time for the fermentation and for the beating, depends alſo upon the cold or hot, the wet or dry weather, in which the herb goes thro' the ſaid proceſſes, and of the degree of heat or coolneſs of the water made uſe of; all theſe caſualties render the practice of this art variable, obſcure and ſubject to many errors, and failures during the proceſs.

BRITISH MUSEUM 1753 16 69 OCT

Theſe

Theſe difficulties of which we ſhall render a more particular account hereafter, and of the proper precautions to be taken againſt them, are the cauſe that many trials have been made to find a method of ſuppreſſing a part of the labour called *beating the extract*. But it does not appear that any attempts have ever perfectly ſucceeded: which is by no means ſurpriſing, becauſe it would probably be neceſſary to diſcover a precipitant that could act upon the principles of the Indigo in an equal degree, whether at the time it goes through its ſpirituous fermentation, or whether at the time it yields to the influence of the acid fermentation, ſince the extract is often in this laſt ſtate without its being perceived.

It is ſaid by *Burke*, *Rumph* and *Hans Sloane*, that the powder of quick lime (chunam) finely ſifted is made uſe of in the precipitation of the India Indigo: that at Carolina lime water is uſed for the clarification of the extract; and that at Jamaica urine is thrown upon a little of the extract to diſcover the diſpoſition of the particles towards an aggregation which, forms the grain. The effects of theſe mixtures are generally known and have been tried; but perhaps, the firſt trial with lime, not having been executed with every exactitude and ſcience, produced an Indigo which diſcouraged the Artiſts from renewing the trial. As to urine it is pretty well known that it has the property of precipitating the grain more or leſs perfect, in proportion to the perfection of the fermentation and beating; but it does not appear that any effort has been made to render that knowledge advantageous. Beſides it muſt be evident how difficult and unſatisfactory it would be to verify all the efficacy, by much greater experiments and better trials; and yet much more that of *ſpittle*, to which the ſame property is attributed. Mr. Duhamel, well known for his extenſive knowledge, and who was conſulted upon this ſubject, after making mention of the trials above cited, thinks, that a diſſolution of phlogiſtic alkali nearly the ſame as that made uſe of in the preparation of Pruſſian blue, would be the moſt proper.

It appears to us however that among all the matters drawn from the animal or vegetable genus thoſe which have a viſcous or micilagenous quality are very fit to aid the art in this point. Many other mixtures have been tried with partial ſucceſs; we ſhall hereafter mention on what occaſion it would be the moſt proper to make uſe of them; although in fact they can all be diſpenſed with, for Indigo is daily made without theſe ingredients.

The queſtion upon the diſcovery of the true precipitant, thus remains undecided; but there is every reaſon to believe that an able Chymiſt would ſucceed and reſolve it, if his operations were to be ſeconded by all the Proprietors of Manufactories to whom the knowledge of it would be ſo very intereſting.

The lights which the theory and the practice furniſh us upon the objects we have been ſpeaking of, are, that the fermentation is abſolutely neceſſary to the developement of all the principles of the Indigo.

That the more violent the fermentation is, the more the abundance of its ſpirits creates obſtacles to the prompt reduction of its principles into grain: that the eſſential object of the beating, is to help and haſten the evaporation of the ſpirits, in order to facilitate the union of the ſmall particles which form the grain: and in ſhort that the tranſition of the extract from the ſpirituous, to the acid, and then the putrid ſtate, before the formation or completion of the grain, is the principal cauſe of all the varieties in the proceſs of beating.

It would be ſuperfluous to ſay any thing about the plan and order of this work; the object of which being to treat upon the Manufacture of Indigo as practiſed in different countries. The reader will perceive that I have drawn it up from the beſt authors,

thors, and adjoined my own obſervations upon the practice of this art, acquired by long experience, and the informations communicated to me by able Artiſts whom I have conſulted ſince I undertook the work, upon which I have re-united all my attention to render it uſeful to our Colonies, worthy of the Public, and of the approbation of Government.

PATENT OFFICE LIBRARY

CHAPTER II.

Of the Culture, the Soil, and the Crop fit for Indigo.

THE moſt favourable ſoil for the plantation of Indigo, is that which is quite new, becauſe it is commonly full, of ſalts proper for vegetation, and that the inſects which are the moſt deſtructive to it, are not in great numbers, and becauſe the bad herbs or weeds will make but little progreſs on it for two or three years.

ALTHOUGH there are many ſoils of a reddiſh earth and white alſo that are very good, yet when it is intended for Indigo, it is allowed, the preference ſhould be given to a black, light ſoil, and the ground ſhould have a gentle ſlope, becauſe, that inclination preſerves the plants from the lodging of the rains, which are very prejudicial to them; for ſhould it be planted upon flat land where the water can ſettle and becomes ſtagnated, the roots of the plant would rot, the leaves fade, wither and die; and therefore, in ſuch caſe, attention ſhould be had, to raiſe the center of the fields that are ſubject to this inconvenience, and to cut ſmall gutters all round; theſe, ſhould empty into larger ones, and ſo from them into ditches. By taking theſe precautions, the loweſt and flatteſt lands may be brought to good account; but they have always this inconvenience with them, it is neceſſary to wait that the heavy rains, which overflow them, ſhould have paſſed before you begin to plant; for an inundation capable of covering the Indigo for only ſix or ſeven hours, would deſtroy it, on account of the mud and ſlime it leaves upon the foilage. And beſides, the too great humidity, and the heat together rot the ſeeds, or vegetate a prodigious quantity of weeds which choak the young plants, before it is in your power to aſſiſt them by weeding, becauſe the ſoftneſs of the ground renders it impracticable.

On account of the delicacy of this plant, it requires a great deal of cleanlineſs and care; and therefore they clear the ground intended for it as much as poſſible, of all the ſtones, and of all kinds of herbs and weeds. This plant however grows very well upon grounds that are full of the ſmall white ſtones, called lime ſtones, becauſe the earth they are mixed with is generally very light, and abounds with the congenial fertile ſalt of that ſtone, which always keeps it freſh Defective lands require much clearing; attention to this point contributes much to the advancement of the plant, and to the eaſe of the planters. As Indigo does not acquire its ſize and quality, but by the aſſiſtance of gentle ſhowers and great heat; temperate air, and rainy quarters, lands too cool or ſhady, are little ſuited for the cultivation of it. It could not be cultivated for any length of time upon hills, unleſs there were flats upon them, becauſe the looſe earth upon the ſurface, which is always the beſt, is carried off by the rain, and of courſe leaves only a barren ſoil full of ſtone and gravel.

The planters whoſe lands are ſo ſituated as to be ſubject to the inconveniences attending the heavy rains of autumn, and do not wiſh to riſk their ſeeds in that ſeaſon, begin to ſow their Indigo about the end of December, and can continue to do ſo until the month of May. This laſt plantation is alſo the moſt favourable, not being ſo liable to be burnt up; but as the ſeaſon is too far advanced in the month May, the plant will not produce more than two or three crops: after which, the latter ſeaſon arriving, the roots are then ſo exhauſted that the plants die; but the ſeeds ſown at the beginning of November, afford at leaſt five cuttings, though not of the quality we laſt mentioned.

The term made uſe of by planters, of SOWING, or PLANTING of Seeds, may appear exceptionable to many, but cuſtom prevails, and the latter expreſſion is adopted; and indeed, inſtead of ſtrewing the ſeeds over the ground, the method in the Weſt Indies is,

is, to dig holes with a hoe, at a proper diſtance from each other, and in them to throw a certain meaſure of grain. The land ſhould be firſt tilled about ſix or eight inches deep; but in this the nature of the ſoil, and experience muſt guide the planter: certain it is, that the excellence of the plant depends greatly upon the trenching of the earth. One inch of earth is allowed for covering the ſeeds, and a convenient diſtance between the lines, to ſerve as a paſſage for the weeders.

It is indiſpenſably neceſſary to weed the ground three or four times preparatory to planting the grain, which ſhould be done immediately after the firſt favourable rain. If the ground is rather too much uſed, or naturally arid, you ſhould at the firſt tilling, ſtrew the old Indigo roots and ſtubble, or any other manure, over it; the advantages derived from this practice amply recompence the planter, although it is not attended to, ſo much as it ought to be.

Instances of planting dry do happen, by which is meant planting ſeeds in very dry weather, in order to advance the crop upon only a ſmall part of the land, becauſe, one or two ſucceſſive ſhowers of rain, is not ſufficient to admit of planting upon any great extent of ground. This method of planting is not riſked, but at a time when there is a probability of rain or the approach of the rainy ſeaſon. Holes are then made in the dry ground, to receive the grain, which ſhould be immediately covered; this, is a great advancement to the planters, when his expectations have not failed. He will perceive his plants all riſe at once on the ſmall ſpots, and can on the like occaſions (light ſhowers of rain,) continue to plant upon other plots of ground: but on the contrary, if he had planted all his ground and that the weather continues dry, more or leſs, he runs the riſk of loſing all his grain, which is burnt or hardened by the extreme heat. Partial ſhowers of rain even paſs at that ſeaſon, but, as they only ſlightly wet the ground, they force the grain to ſhoot, and rot the ſprouts, which have not the ſtrength to get much above ground: And conſequently the loſs to the planters is evident, although

not

not ſo great, but that the advantages he would derive, if his trial was ſucceſsful, ſhould ever encourage him to riſk.

When the *Indigo franc*, is timely planted, the third day after rain it appears above ground; but the *baſtard Indigo* is ſometimes more than eight days before it ſhoots, ſometimes ſooner, and at others later, according to the quality or the degree of maturity of the ſeed, and for that reaſon never all at once: at every ſhower of rain ſome ſprout out; it is not rare to ſee the ſeeds that were planted one year, grow up the year following, which ariſes from their being left to ripen too long, before the pods were gathered; and therefore great care is obſerved to prevent an exceſs in the maturity, by gathering immediately the pods begin to grow dry. This herb impoveriſhes the land very much, and therefore ſhould be always kept alone; The weeding muſt never be neglected. The firſt weeding is generally given about fifteen days after the plant is above ground, and continued every fifteen days.

When the Indigo is come to maturity it is cut at about one inch above ground, and then carried to the vats.—It ſhould be obſerved, this plant is ſo much diſpoſed to ferment, that by leaving the bundles which may have been made up, though but for a ſhort time, the herb becomes burning hot. And therefore the conſequences, which are very prejudicial to the manufacturer, call for every attention, and his ſeeing that the bundles are ſent to the vats as faſt as they are cut; but if the plantation is at any great diſtance from the manufactory, it would be adviſeable to employ carts or cattle.

The cuſtom in large manufactories is, to vat the herb towards the cloſe of the evening, or early in the night, by which means you are able to judge more preciſely of the degree of fermentation at the enſuing day break, and alſo of the time when the extract can be drawn off to advantage, than if the herb was vated earlier; becauſe the fermentation might come on before day, and oblige you to judge of its juſt degree, by candle light, which is both difficult and hazardous.

PATENT OFFICE LIBRARY

CHAPTER III.

Preparations, and a General Deſcription of the Handicraft of Indigo.

THE quality of the waters made uſe of, have a great influence on the manufacture of Indigo; thoſe of rivers and ſtreams that are clear, and neither of too cold nor of too hard a nature, are the moſt proper for penetrating and diſſolving the plant, and therefore they ſhould be preferred to well waters which are of a ſaline nature, and theſe laſt ſhould be preferred to troubled river waters, becauſe their ſlime and mud, ſuſpend the activity, and that their ſediment alters the quality of the Indigo very conſiderably. It is neceſſary on this occaſion to mention that the waters which have been kept in reſervoirs for a long time, with a view of having it in readineſs for filling a vat at once, and which waters are frequently uſed to ſeaſon a vat that is about to be made uſe of, may in corrupting by the great heat of the ſun, and by the inſects which get into it, retard or ſpoil the diſſolution expected; although it muſt be allowed that the advantages of this method, are leſs toil and greater expedition for the manufacturer and labourer.

We think ourſelves alſo bound to obſerve, that the Indigo made with ſalt or brackiſh waters is a bad acquiſition; for, although it has a fine appearance, yet when it is expoſed to the open air for a long time, the ſaline principles retain or attract a dampneſs which always ſhows itſelf when ſhut up or caſed; and therefore renders it much heavier when offered for ſale, and very unmarketable when delivered either on ſhore or from ſhips.

When the herb is cut, they put it into the firſt vat, called the *ſteep*, they ſpread it therein, in ſuch manner as not to form a maſs, nor yet ſhould it be ſo thinly ſpread as to leave too much ſpace. Upon this are placed a number of ſmall rafters, which are kept

kept down at their ends by ſtronger rafters or bars fixed into the mortiſes of poſts drove down on each ſide of the vat. Many methods may be contrived to ſerve the purpoſe of keeping down the herb in the *ſteeping vat, and therefore we do not attempt to deſcribe one, as we cannot offer a deſcriptive plate with it.* If the plant is properly kept down, it is all that is required; however the compreſſion of the herb muſt not be too great leſt it may deſtroy the good effects of its dilitation and of the developement which the fermentation ought to occaſion.

When the vat is thus prepared, fill it, as conveniently as you can with clear river or other water, to within ſix inches of the border. The Indigo ſhould then be covered about four inches; ſhortly after you have poured in the water, there will riſe with a kind of guſh, from the bottom of the vat, large air bubbles, and a liquor, which breaking or falling, form as many circles, and ſpreads a light green tinge over the ſurface, and theſe by degrees change, and the water becomes of a very bright green: when the green colour has acquired its higheſt degree, the furface becomes covered with a a beautiful coppery hue, and this in its turn by a ſcum of a very deep violet colour, although, the maſs of the water remains always green. The vat then having its proper degree of heat, throws up in every part of it, large bodies of ſcum. This ſcum is ſo ſpirituous, that if you apply fire to one, it rapidly communicates to every ſucceſſive body that riſes, and the indigo during the fermentation, ſometimes makes ſuch violent efforts, as to burſt the rafters and bars, and even tear up the poſts, unleſs they have been well ſecured in the ground. When a vat produces the like effects, it is ſaid in technical terms *to thunder*.

This fermentation which laſts more or leſs, accordingly to the quality or body of the herb, and according to the coldneſs and heat of the weather, as alſo the dry or rainy ſeaſon, diſengages the juices from the herb, and developes the parts proper for forming

forming the indigo. To judge of the diſpoſition of all the principles, towards a ſpeedy union, you ſhould ſound the vat, in which the matter is at that time ſo thick, that it will bear an egg upon it. This experiment is made with a round ſilver cup with a handle to it, filling the ſame about one third with the water of the *ſteep vat*: the inſide of the cup ſhould be highly poliſhed and clean, becauſe it is from the bottom you are to form a judgement of the ſtate of the vat: if the cup it not clean and bright, it makes the water appear troubled and different from what is really is; inſomuch that you may imagine the indigo has diſſolved too much, when it has not probably diſſolved enough; and though you can perceive it afterwards at beating, a loſs will always reſult, even when you find out this error which proceeds from ſuch a mere trifle. For this reaſon it is recommended by moſt manufacturers, to make uſe of a cryſtal cup as the ſureſt manner of trying the ſtate of the vat.

The deſired information is obtained by the motion of the cup, the agitation of which produces nearly the ſame effect as the beating would operate in the ſecond vat (or *battery*); that is to ſay, if the matter had fermented ſufficiently in the *ſteeping vat*, ſo as to diſpoſe the parts to a ſpeedy union, the beating accompliſhes the work, and in like manner by agitating the cup, ſmall maſſes or grains form themſelves more or leſs diſtinct, according to the quality of the herb, and the degree of fermentation it diſcovers at each time the proof experiment is made. When that grain which is not larger than the ſmalleſt grains of muſtard, is well formed, it ſinks by its own weight to the bottom of the cup, and generally leaves the water above it of a clear yellowiſh colour, ſomewhat reſembling the colour of old coniac brandy or an aſiatic topaz; this is what is remarked after the cup has been agitated, you incline it though ever ſo little, but juſt enough to diſcover one ſide of the bottom: you then not only ſee the effects abovementioned but alſo a ſubtile fine grain roll and get away from the higheſt border, which it ought to leave perfectly clean, and the water forming towards that border, a

very

very clear rim, well detached from the grain. This experiment is tried from time to time until the indications are as ſatisfactory as the circumſtances will permit, a detail of which we will give in its proper place. The importance of theſe indications or ſigns, obliges us to forewarn the artiſt that it is not enough to ſound the vat at the top alone, if he is deſirous of knowing the true ſtate of his vat; becauſe the Indigo of a hilly or mountain growth, very often ſhews a falſe grain upon the ſurface: beſides the herb which is underneath begins to ferment ſooner than that above, and remains above two hours before it ſinks; and in rainy weather, when Indigo requires but ten or twelve hours of fermentation, the top of the vat changes ſo little, that you would look in vain for a grain which it hath not the force to develop or furniſh. It is therefore the duty of an artiſt to ſound the vat equally at the bottom, which is done with a horn or other vaſe fixed at the end of a pole, and therewith conveyed to the bottom, to bring up ſome of the water; or, by drawing off a little through the cock, in order to compare the difference, and to continue alternatively till he finds it to have acquired the requiſite qualities. When the proof cup offers nearly the grain and the water which could be expected from the quality of the Indigo, it would be imprudent to expoſe the particles of the grain, to a longer fermentation, for that would occaſion a diſſolution, from which the beating could not retreive them: and conſequently cauſe the loſs of the whole vat. Therefore it is proper to ſeize the moment mentioned, for drawing off the extract from the *ſteeping* vat into that *of the battery* (or beating vat,) which extract is then of a deep green colour. Although it may appear of little importance to the manufacturers to know that the green colour is the reſult of the combination of yellow and blue, it is not however leſs true that all their labour has a direct and eſſential relation to the knowledge of this law, and which is by no means a matter of indifference to them; ſince all their art conſiſts but in developing the principles of thoſe colours, in order to ſeparate them the more eaſily, and then to reject the yellow, and, reſerve the blue part: to do which with exactitude conſtitutes the perfection of this art.

It is preſumable that the fermentation diſcovers a great quantity of alkaline ſpirits in the Indigo. The nauſeous ſmell which the fecula exhales during the courſe of the preparation, and which recommences when you put the dried Indigo to the ſweating operation; the white duſt or flour that covers it and daily encreaſes as it drys, ſeem ſtill more to indicate the abundance of alkali contained in this matter.

It may alſo be preſumed that alkalies ſerve as the baſis to the yellow part of the extract, and that they concur with the acids to the different developments of the fermentation.

To return to our ſubject, the preparation which the extract receives in the *battery*, conſiſts in the violent agitation, and overturninng occaſioned by the fall of the beating buckets; by that motion, all the parts proper for compoſing the fecula meet, adhere and concenter, forming ſmall bodies of different ſizes, according to the ſtate of the herb, of the fermentation and of the beating. Theſe ſmall maſſes are what we call the grain.

By the agitation, the water which at firſt appeared green, becomes inſenſibly of a very deep blue. During the courſe of the beating, a very thick ſcum or froth riſes under the ſtrokes of the buckets; to diſperſe which, ſome, ſprinkle a little fiſh oil from time to time, others a handful of bruiſed Palma Chriſti ſeeds which is very oily, and anſwers the ſame purpoſe, of keeping down the froth. The ſize, the colour and the ſudden or ſlow diſappearance of that froth ſerve, jointly with the ſigns given by the proof cup, to indicate the quality of the herb, the exceſs or want of fermentation, and to regulate the beating.

When the grain delays appearing in a proper form, you ſhould excite it by the continuation

tinuation of the beating, which you always regulate by the help of the trials and ſigns before mentioned, until you find them entirely to your ſatisfaction. When it is nearly of the bigneſs it ought to be, you ſhould examine the diminution in the vat which the beating ought neceſſarily to occaſion, this is called the *refining*; by that means it becomes round, concenters, in ſuch manner as to ſink to the bottom of the cup, where it rolls about perfectly. You then ſtop the beating; the water that keeps the yellow part and the other ſuperfluous principles in diſſolution, ſeparates, ſome time after, from the fa-cula, and becomes gradually clear on account of its ſubmerſion. Two or three hours are enough to leave the vat to ſettle, when there has been nothing neglected nor wanted in the proceſs; but if you are not preſſed, it would be better to leave it for four hours, in order that the lighteſt grain may have time to ſettle, and that leſs water may be mixed with the ſediment; After it is well ſettled, you ſhould only open the firſt plug of the vat, that the water may run off without rendering the remainder troubled; when this is done the ſecond plug ſhould be opened, and then, the fecula is left at the bottom of the vat. We ſhall hereafter give a particular deſcription of the vats, their dimenſions, &c. &c.

Monsieur de Reine, an old inhabitant and planter of the iſland of Mauritius, ſays, that after the proceſs of beating, he uſed to leave the vat to ſettle for twenty-four hours, and that his Indigo was equal in quality, to the fineſt that came from Aſia.

The water drawn off from the two firſt cocks of the battery naturally falls into a third vat, or rather a reſervoir, called the *receptacle*, which fills and empties into ſome ditch or marſh that has no communication whatever with any ſtream or tank in uſe, becauſe this liquid would render thoſe waters poiſonous; The conſtruction of the *receptacle* is alſo what we ſhall deſcribe in our chapter reſpecting the neceſſary buildings for practiſing this art with ſucceſs. The water from the two firſt cocks of the *bat-*

tery

tery, if the proceſſes have been perfect, will be clear, and of a fine amber colour, and when well run off, you ſhould give a little vent to the third cock, juſt enough, to drain off ſlowly the ſmall quantity of water, that naturally remains with the ſediment in the *battery*; if the ſediment ſtops the iſſue it ſhould be puſhed back; practice will ſhew that there is little trouble or difficulty to execute this laſt proceſs; it ſhould be continued however until ſcarce any water drops; you afterwards let out the water from the *receptacle*, preparative to receiving the fecula. Some perſons make uſe of a ſquare plug for the third cock of the *battery vat*; the hole of which being round, the water drips through the iſſues which the ſquare plug forms: finally this laſt plug is taken out, that all the ſediment, then in a ſtate of fluid mud, of a blue and almoſt of a black colour, may run into the *receptacle*, which has been beforehand carefully cleared out of the water, and a man is ſent into the *battery*, to ſweep out the matter that may adhere to the bottom or ſides of that vat; under the third cock of the *battery* a baſket is ſuſpended for the purpoſe of intercepting all the foul or other foreign matter that may have ſettled or mixed with the ſediment; if any ſhould paſs through, it is eaſily taken off with a ſkimmer, the fecula is thereafter withdrawn and put into linnen bags, and hung up as deſcribed in the article reſpecting the buildings: the Indigo is left to drain in this manner until the next morning; When, ſhould they drip no more, they ſhould be divided into two parts, and by tying the cords of each half, the number of bags together be again hung up: this aſſemblage preſſes them and ſqueezes out the remaining water; you then turn out and ſpread the fecula into ſhallow boxes which ſhould be put during the day time upon ſtands or *horſes*; theſe ſtands are placed at the drying houſe, ſo that one half be under cover and the other expoſed to the open air, ſhifting the boxes every day. The bags ſhould be clean waſhed every time they have been uſed.

The Indigo inſenſibly dries, and as ſoon as the ſun penetrates it, it cracks as dry mud does. The evening ſhould be preferred for this operation, becauſe a too ſudden and

continued

continued heat upon the matter renders the ſurface ſcaly and uneven: this does not happen when it has received five or ſix hours heat, and then an interval of coolneſs which allows the matter to acquire an equal conſiſtence. At this period a trowel is paſſed over the ſurface, to compreſs and rejoin all the parts, but without turning the Indigo cake, becauſe that would injure the quality of it; in ſhort, after it has acquired a proper conſiſtence, you again make uſe of the trowel for poliſhing the ſurface, and afterwards cut it as it lays in the boxes, into ſmall ſquares, of about an inch and an half ſquare: continue to expoſe it to the ſun, not only until the ſquares detach themſelves from the boxes with eaſe, but alſo until the matter appears entirely dry. Even then however, Indigo is not deemed deliverable or merchantable, until it has been ſweated; becauſe if it was to be packed up in the ſtate that it is taken from the boxes, you would ſome time after find in your packages, nothing but fragments of ſpoilt paſte, and hardly ſaleable; and therefore the ſweating proceſs is abſolutely neceſſary, which is, to put the cakes into caſks of which the ſtaves are looſened, and the head taken off looſely, replaced and then covered with plantain leaves; cheſts looſely put together are alſo uſed—The Indigo cakes are heaped therein, ſo as to leave a free circulation of air, and ſhould remain thus for three weeks; in which time it goes through a perfect fermentation; it heats to ſuch a degree as not to be borne if the hand is put into the caſk; it diſcharges large drops of water, exhales a naſeous vapour, and becomes covered with a kind of flour or white mould: in ſhort the Indigo being afterwards uncovered, but not expoſed to the air again, will naturally dry in five or ſix days. All theſe effects probably proceed from the ſtate of dryneſs and of contraction which that matter has gone through, and, being covered or ſheltered, naturally tends to dilate, and admits the exterior air, which inſinuates itſelf, to introduce the humidity with which it is charged. This action of the interior air which tends to ſlacken, and the cool exterior air which inſinuates itſelf with its humidity, communicating to all the parts of each maſs, ought neceſſarily to occaſion a derangement and a motion, followed by a heat ſufficiently great to produce

all the phœnomenon of the fermentation of which we have been giving the deſcription.

It is even to be preſumed that Indigo goes through the ſame kind of criſis more than once, above all when croſſing the ſeas, unleſs it has been ſhipped extremely dry and cloſely packed.

It is very certain and yet few perſons notice it, that Indigo weighs much leſs before it is ſweated, than directly after it has gone through that operation.

When the Indigo has been well ſweated, it is properly conditioned for ſale, and it is of importance not to delay the ſale, becauſe the diminution to which it is liable for the firſt ſix months after the ſweating, by drying, is, at a fair eſtimation ten per cent. and often more.

Some manufacturers dry their cakes of Indigo in the ſhade, immediately after they can be taken out of their boxes with eaſe; it is true that this is a work of time, requiring more than ſix weeks before it will be fit for ſweating: but this method of drying is by far the beſt; the matter ſeems to acquire by it a new conſiſtency, and its brightneſs improves by the gentle diſſipation of the humidity, which covers it in that interval with a very white flower or mould. It is certain alſo that this laſt method renders the matter leſs liable to waſte than the former, and produces an Indigo of a ſuperior quality. Therefore it could not be too much recommended to the manufacturer to purſue this practice. Thoſe however, whoſe drying rooms are overſtocked with boxes, could not well adopt this plan, unleſs they were to erect broad floors or ſhelves all round the inner part of them, and then they might place the Indigo thereon where they might properly ſweat in the manner as before mentioned.

It

It is neceſſary we ſhould make ſome obſervation upon the cuſtom of kneading the paſte of Indigo. When it begins to dry in the boxes, many imagine that this operation gives the matter a conſiſtence: but it is a miſtake; the conſiſtency depends ſolely upon the degree of the fermentation and of the beating the Indigo has gone through, and eſpecially this laſt, which is eaſily verified by the Indigo of a vat which is defective in one or the other caſe; the Indigo goes to pieces at the ſmalleſt preſſure, becauſe the proper method or neceſſary proceſs had not been obſerved; and it is abſurd to expect to improve or reſtore the quality by kneading the defective parts: on the contrary a loſs is often the conſequence; for by mixing the top with the bottom of the box, (ſuppoſing the top to have been hardened or impaired by the heat of the ſun) it forms veins in the paſte of a dull ſlaty colour, and conſequently diminiſhes the value of the goods. Thoſe who ſtudy their own intereſt, ſeperate the Indigo from the boxes the next day or the morning following that, which makes a difference of ſix days ſhorter in the time, from what others require for drying; and beſides they find another advantage in it, for the longer the Indigo is to dry, the more its ſmell increaſes and attracts the flies, which lay their eggs upon it: thoſe eggs in leſs than forty-eight hours become worms, that get within the cracks of the Indigo, eat it in part, and ſpoil the reſt by ſpreading a vicious humour which prevents it from drying; whence a real loſs accrues as well in point of weight as of quality, and a great delay particularly in rainy weather, as it is then neceſſary to keep a conſtant fire in the drying rooms, in order that the ſmoke may drive away the inſects.

Almost all theſe inconveniences might be obviated if, as in certain parts of the Eaſt Indies, where they are accuſtomed to knead their Indigo, and dry it entirely in the ſhade, it was firſt ſpread in boxes of half an inch deep; and if after having divided it into ſquares, they put them into other boxes that had been heated in the ſun: this method, would certainly require a greater number of boxes; but as the Indigo would dry much ſooner,

the

the boxes would be the ſooner ready for ſervice, this augmentation would not be ſo conſiderable as might be at firſt imagined; and as from all appearance, the Aſiatic Indigo derives a great part of its fine quality from an exact attention to theſe different practices, we might expect nearly the ſame ſucceſs with reſpect to the Indigo of our colonies by allowing even an inch in depth to the boxes. It is true that the merchants not accuſtomed to buy the Indigo in large ſquares, would be ſurpriſed at firſt at the difference of the ſize of theſe; but if the merchandize was really the better for it, they would not long ſcruple about the form nor ſize.

When the herb is taken from the *ſteeping vat* after the fermentation, the ſtocks and branches do not appear to have changed; but the leaves which ſcarcely hold to them are ſo ſoft and livid, that it is eaſy to imagine that it is the leaves that alone contribute to furniſh the fecula; we may however be allow ed to ſuppoſe that the body and ſkin of the plant do furniſh ſome fermentative juices and of the yellow colouring. But alone, they could not poſſibly form the grain, which is evident, becauſe when the inſects have eat up all the foliage, the remainder of the plant will produce nothing, or ſhould there be a ſmall portion of ſediment, it ſhould rather be attributed to the quality of the green and tender extremities of the branches which perhaps may participate of the quality of the leaves, as alſo that of the ſkin.

In ſome manufactories, when water is ſcarce, on account of exceſſive drought, they keep that, which has already ſerved for one fermentation, and put as much as can be ſaved upon a vat of freſh herb; a great ſaving both of trouble and expence for filling up the *ſteeping vat*. Such caſes are very rare; but it is pretended that this practice is by no means prejudicial to the manufacture of Indigo.

We will now finiſh this Chapter, with a few additional advices about the cultivation.

The

The herb after having undergone the proceſs of fermentation, is an excellent manure to lands intended for Indigo; and indeed may be uſed immediately it is taken out of the *ſteeping vat*.

In ſtrict economy, you muſt obſerve that, when you have ſown one half of a tract of ground, you ſhould allow an interval of a month or ſix weeks before you ſow another, and ſo on with more lands. By this precaution you guard againſt the inconvenience occaſioned by the rains, which often oblige you to delay the cutting of the herb; and beſides, the difference of their age, gives you the advantage of cutting them alternatively as they become properly mature. The reſpite which this interval admits of, ſhould be employed in the firſt weeding or any other indiſpenſable work, which cannot be put off until the cutting ſeaſon, when, there is ſcarce time left to weed the remainder.

At the approach of the cutting ſeaſon, it is neceſſary that the artiſts ſhould make a general examination of all the Indigo works, aſſure himſelf of the ſtate of them, ſee that every thing be perfectly repaired and well conditioned; the vats muſt be ſtrictly attended to, ſo that no accident might happen during the crop, which would oblige him to ſtop and repair, and thereby cauſe a great injury to the Indigo by the cooling of the vats, and by rains which might unexpectedly fall; theſe inconveniences throw the work ſo much back, that the artiſt is often three or four days before he can again find the juſt degree of the fermentation of the herb. A proper order being eſtabliſhed, the artiſt will only have to attend the cutting, *vatting*, and weeding until the firſt crop is finiſhed; after which he ſhould apply himſelf to the moſt neceſſary work preparatory to the ſecond crop, which will not delay; this crop requires a great deal more vigilance, as much on account of the inſects and worms, conſiderably increaſed in number, and increaſing daily, as on account of the body of the herb, which requires a longer ſteeping before it rots; but at the ſame time it alſo produces much more Indigo than the firſt.

PATENT OFFICE LIBRARY

CHAPTER IV.

The practice of the Theory of the Manufacture of Indigo.

PREAMBLE.

AS *rottenneſs* is a term uſed among the Manufacturers of Indigo, to imply every degree of fermentation that a vat of that herb can go through, and the moſt part of thoſe who are unacquainted with this in Europe, are accuſtomed to diſtinguiſh the three different kinds of fermentation, by particular names, of which the effect of the *laſt* only is called *rottenneſs*: I ſhall, as much as poſſible, to avoid miſapplication, make uſe of the term *putrefaction*, when it is meant, the laſt degree of fermentation, which is well known to be unfavourable to the Indigo; and I ſhall employ DEFECT, *and that of* JUSTNESS *of fermentation*, to expreſs the ſtate of the two other degrees, although they are terms not uſed by all Manufacturers.

THE reaſon for my taking notice of this change, may be obſerved in the firſt Chapter of this work.

THE manufacture of Indigo is naturally divided into two parts, namely, the fermentation and the beating. The fermentation is manifeſted by two effects. The firſt, carried to a certain degree, developes all the active and paſſive principles which contribute towards forming the grain, and diſpoſes them to unite and become perfect in the *battery*, where they acquire a conſiſtency and form fit for draining.

THE ſecond effect of the fermentation, or its exceſs, deſtroys the power of the active principles, and occaſions the ſeparation of all the others, of which, the beating cannot

but

but encreaſe the diſſolution, and their mixture with the water, from whence it is afterwards impoſſible to ſeparate them.

THESE two different effects are produced ſooner or later, according to different circumſtances of which we ſhall ſpeak hereafter.

A perfect fermentation has ſometimes been known to happen in ſix hours; but that very rarely, and is a certain proof that the herb will produce very little Indigo. The uſual time is from ten, twelve, fifteen to twenty hours, ſometimes thirty and even fifty, ſcarce ever beyond that time; theſe laſt caſes ſeldom happen, except when the plant is put into a new vat, or in one that has not been uſed for a long time. And when the circumſtance of a dry and cold winter which ſlackens the fermentation, or that of the great heats in the ſummer, which render the plant ſuſceptible of a long efferveſcence, concur to produce that effect.

THE beating or agitation of the matter in the *battery*, produces alſo two principal effects. The firſt properly managed, determines and perfects the union of the particles and the formation of the grain, which a well conducted fermentation had only began or prepared.

BY the operation of beating, all the particles proper for forming the grain, ſunk and diſperſed in the maſs of water, according to their ſpecific weight, are agitated and toſſed about, meet, and join together in bodies of different ſizes and form, according to the quantity and quality of the juices, as well as the force and length of the agitation they have gone through.

FISH oil, as we before obſerved, is made uſe of to keep down the deal of ſcum

that

that riſes at the ſtrokes of the beating buckets; and that is done by ſprinkling a certain quantity upon the matter in the *battery*, three or four times during the operation. It may be ſuppoſed that the oil contributes towards the union of the principles, which perhaps require but that addition to form new bodies, or that it ſerves at leaſt to perfect the unity of each maſs, and that it preſerves them from the impreſſion of the water; which, added to their particular form, diſtinguiſhes, one from the other, even when ſettled and facilitates the moſt perfect draining. I muſt however obſerve that the uſe of oil has been totally ſuppreſſed in ſome manufactories, and that the artiſts have found no inconvenient reſult, either in reſpect to the beating, or in point of the quality of their Indigo.

The exceſs of beating produces very nearly the ſame effect as the exceſs of the fermentation. It deſtroys the active power and union of the grain, and reduces it into ſuch ſmall particles, that after it is ſettled at the bottom of the vat, and then put into the bags, the water cannot drain off.

So that you may eſtabliſh it as a general rule, with all Indigo which does not drain well that it has failed, either through an exceſs of beating or of fermentation.

As there is no fixed time for the fermentation or the beating, you attain a knowledge of the juſt point, ſucceſſively of the one and the other, by taking notice of the quality of the herb which generally has an influence upon the duration of theſe two proceſſes, and alſo by obſerving certain indications which appear during the courſe of both the operations; but as theſe two objects cannot admit of a longer detail in common, we will divide them into two chapters; one with regard to the fermentation, and the other to the beating.

To remove all difficulties upon the contents of the following chapters, we will obſerve that

that in the hot weather the fermentation declares itſelf much ſooner than in the cold; from whence it follows that the herb put into a vat in the hot ſeaſon, requires a much ſhorter time to acquire its firſt degree of rottenneſs, than an herb vatted during cold weather, and conſequently that this laſt ought to remain a longer time in the vat than the former, provided there may not have been a very great difference in the quality of one and the other herb. For it is certain that, if the cold contributes to prolong the ſteeping of the herb, the diminution of the ſtrength in the body of the herb, occaſioned by the cold, on the other hand ſhortens the time of its boiling or effervescence; ſo that agreeing upon this diſtinction, it may be ſaid that the herb requires more rottenneſs or ſteeping if the winter is dry, than in ſummer, ſuppoſing them to be of equal quality, and even, in the caſe that the winter herb ſhould have, rather a leſs body; but it muſt be alſo allowed that, that diminution of quality in the plant, always and neceſſarily occaſions a diminution upon the time of the real fermentation, and leſſens in ſo much, the time of ſteeping.

But rain contributes ſtill more than the cold to diminiſh the quality of the herb, and it does not fall equally in all places at the ſame ſeaſon. In ſome countries it rains at intervals throughout the year; in others only periodically and abundantly, when they are ſucceeded by dry and cold weather which continue until about the month of March. The reſult of this tranſition is, that plantations at no great diſtance from each other, find a conſiderable difference in the quality of the plants at the ſame time of the year; that difference of quality and alſo of temperature, is the reaſon that artiſts do not then agree, as to the manner of treating the vats, and therefore the method of one, ſeems to oppoſe that of another, although in the main all agree to the ſame principles, which I ſhall endeavour to explain to the utmoſt of my ability; hoping that by the means of this preamble, every one will underſtand the intent of the diſcourſe, and will make the proper application to thoſe caſes, of which the diverſity is ſo common in the manufacture of Indigo.

PATENT OFFICE LIBRARY

CHAPTER V.

Of the fermentation of Indigo.

WE obſerved in our firſt chapter, that the art of manufacturing Indigo does not indicate a preciſe rule for the duration of the fermentation, becauſe this point depends upon the quality and body of the herb, and that quality, upon the nature of the ſoil on which the herb had grown; and the change of weather it might have experienced before it was cut. We added that the progreſs of the fermentation depended alſo upon the cold or hot weather, rainy or dry, during the time the herb is in ſteep, and the degree of heat or cold of the water into which it was put to macerate; but as among all theſe circumſtances the quality of the herb has the greateſt influence upon the length of the fermentation, and upon the ſtrength of the ſigns which guide the artiſt for drawing off the extract, and that the cauſes of which we have before ſpoken can vary the quality of the herb without end, we will make choice of the three principles ones to form the ſubject of three ſeparate articles, in which will be ſucceſſively found all that concerns this proceſs, and the circumſtances capable of haſtening or ſlackening the effect.

THE firſt will indicate to us the reaſons why an herb that has ſuffered the inconvenience of a rainy ſeaſon, or of a ſoil that is too damp, requires a ſhort fermentation, the effects which accompany it till in its putrefaction, and the means to avoid theſe inconveniences. We will add to that article a detail of the cauſes which can determine, not a longer efferveſcence, but the neceſſity of its remaining a further time in the *ſteeping vat*.

IN the ſecond, we will furniſh the ſame explanations upon the neceſſity of a longer fermentation with reſpect to the herb produced upon a good ſoil and attended with the moſt favorable circumſtances of warm weather.

We will expoſe in the third, the cauſes which determine a middling fermentation, with reſpect to the herb that has ſuffered a long draught, or has been left uncut beyond the proper time; we will add thereto, proper inſtructions, as well as to the preceding articles.

ARTICLE I.—All good practioners, before they order their Indigo to be cut, ought to pay attention to their herb, the ground on which it grew, and be mindful of the accidents it may have met with until then, that they may be better able to judge how far they ought to carry the fermentation and afterwards the beating.

The method from theſe preſumptions, is of great help to the artiſt, when he has experience enough opportunely to correct and rectify any ſmall overſight, which can often happen. The examination above mentioned, managed conformable to the order of circumſtances, and the proceſs, naturally leads the artiſt to the examination of the firſt crop and firſt vat. The firſt ſteeping is always the moſt embarraſſing, becauſe the ſun may then be at ſome diſtance, the rains are frequent in the firſt part of the ſeaſon, which with the exceſſive coolneſs of the ground, having made the plant tender and filled it with bad juices, the developement is ſo prompt and the effervescence ſo weak, that it is difficult to diſcover and ſeize the true point, at which the fermentation ought to be ſtopped.

The ſigns which accompany this fermentation and its produce, anſwer to the weakneſs of their principles; it renders little ſcum, and ſometimes ſcarce any appears; The heat and the developement of the parts are concentrated towards the bottom of the vat; the grain is ſmall, it changes and diſſolves in an imperceptible manner almoſt immediately after it is formed, and gives the water, in which it is too much divided, a troubled or dirty appearance.

The doubts which the weakneſs and obſcurity of thoſe ſigns occaſion, even when you have ſeized the juſt point; the ſlight appearances of conformity they have with thoſe of a vat of good herb that hath not fermented enough, or perhaps too much, and the inconveniences which reſult from the confuſion you yourſelf may create, oblige us to enter into all the neceſſary explanations, how to avoid them.

You will diſtinguiſh that the vat in queſtion, is at its juſt point of fermentation, and in the beſt ſtate poſſible, if the grain, however badly formed, ſeparates freely after the agitation of the proof cup, and if the water becomes of a yellowiſh green colour. You will know this from a vat of good herb that has not fermented enough, of which the colour is ſometimes ruddy, approaching that of beer, and moſtly of a lively green, that leaves no ſcum or filth upon the ſurface of the cup. The redneſs of the water ought not however to be conſidered as a certain ſign of a *defect* of fermentation; for you meet frequently in your trial cups that the water is entirely ruddy, although the matter had acquired the proper degree of fermentation. For that reaſon I ſhall here add three ſure remarks, which the artiſt can make uſe of, whenever he has the leaſt doubt upon the ſtate of his vat. The firſt is to take a drop of that water which ſplaſhes up, either from the cup or from the vat, into his hand; if it is a ſtate of putrefaction, it leaves no mark, or at leaſt it is ſo weak, that it effaces as it drys; but when it requires ſome hours of fermentation, the water is ſo ſharp that even the uſe of ſoap will not take off the mark it leaves, except by repeated waſhing. The ſecond conſiſts in the ſmell of the vat, which is very nauſeous when the fermentation has exceeded. The third depends upon the artiſt taking notice of the water that riſes towards the borders of the vat as the fermentation encreaſes, and the retreat of it which leaves a trace and announces that the criſis of the fermentation is paſſed.

To be certain of this laſt indication, it is neceſſary to meaſure the height of the wa-

ter

ter in the vat after covering the herb, and then ſeize the moment when the abatement of the fermentation admits of your ſeeing the half or two thirds of the interval between the firſt meaſurement and the trace, when you ſhould draw off the vat.

If, through want of attention to the foregoing advice, and upon the firſt appearance of the likeneſs of the grain of an herb of a weak quality well fermented, with that of a good herb that is not enough ſo, you ſhould reſolve to continue the fermentation in the idea of perfecting the grain, the vat will go into *putrefaction*, and you will loſe the whole without reſource.

But if a vat has got into that ſtate during the abſence of an experienced man, he will eaſily diſcover the exceſs, in ſpite of the conformity and reſemblance of this, diſorderly mixed, to a grain, of which the fermentation has but juſt begun; becauſe the firſt does not ſeparate like the other and it remains floating in the water, the colour of which is ſometimes of a pale yellow, of a dirty green, and oftener bluiſh. He will further perceive, upon the ſurface of the proof cup, a kind of bead, which by uniting forms a half circle like a rainbow, and alſo a thin pellicle or whitiſh ſcum upon the vat; which is a proof of exceſs. It is true that the bead in like manner ſhews itſelf in the cup or the vat when the juices of the plant have been injured by continual rains, or when the herb is too mature, which always happens when left to run to ſeed; but theſe beads does not touch each other as thoſe of a vat in which the putrefaction is juſt begun.

From all this it ought to be inferred that the artiſt ſhould be particularly attentive to the good quality and cleanneſs of the water, to regulate the fermentation of the firſt vat, when filled with an herb, ſuch as we have deſcribed at the beginning of this article; without much minding the ſmallneſs of the grain, provided it ſinks well, and that he takes care to conform the beating which is given to it afterwards with every poſſible

The doubts which the weakneſs and obſcurity of thoſe ſigns occaſion, even when you have ſeized the juſt point; the ſlight appearances of conformity they have with thoſe of a vat of good herb that hath not fermented enough, or perhaps too much, and the inconveniences which reſult from the confuſion you yourſelf may create, oblige us to enter into all the neceſſary explanations, how to avoid them.

You will diſtinguiſh that the vat in queſtion, is at its juſt point of fermentation, and in the beſt ſtate poſſible, if the grain, however badly formed, ſeparates freely after the agitation of the proof cup, and if the water becomes of a yellowiſh green colour. You will know this from a vat of good herb that has not fermented enough, of which the colour is ſometimes ruddy, approaching that of beer, and moſtly of a lively green, that leaves no ſcum or filth upon the ſurface of the cup. The redneſs of the water ought not however to be conſidered as a certain ſign of a *defect* of fermentation; for you meet frequently in your trial cups that the water is entirely ruddy, although the matter had acquired the proper degree of fermentation. For that reaſon I ſhall here add three ſure remarks, which the artiſt can make uſe of, whenever he has the leaſt doubt upon the ſtate of his vat. The firſt is to take a drop of that water which ſplaſhes up, either from the cup or from the vat, into his hand; if it is a ſtate of putrefaction, it leaves no mark, or at leaſt it is ſo weak, that it effaces as it drys; but when it requires ſome hours of fermentation, the water is ſo ſharp that even the uſe of ſoap will not take off the mark it leaves, except by repeated waſhing. The ſecond conſiſts in the ſmell of the vat, which is very nauſeous when the fermentation has exceeded. The third depends upon the artiſt taking notice of the water that riſes towards the borders of the vat as the fermentation encreaſes, and the retreat of it which leaves a trace and announces that the criſis of the fermentation is paſſed.

To be certain of this laſt indication, it is neceſſary to meaſure the height of the wa-

ter

ter in the vat after covering the herb, and then ſeize the moment when the abatement of the fermentation admits of your ſeeing the half or two thirds of the interval between the firſt meaſurement and the trace, when you ſhould draw off the vat.

If, through want of attention to the foregoing advice, and upon the firſt appearance of the likeneſs of the grain of an herb of a weak quality well fermented, with that of a good herb that is not enough ſo, you ſhould reſolve to continue the fermentation in the idea of perfecting the grain, the vat will go into *putrefaction*, and you will loſe the whole without reſource.

But if a vat has got into that ſtate during the abſence of an experienced man, he will eaſily diſcover the exceſs, in ſpite of the conformity and reſemblance of this, diſorderly mixed, to a grain, of which the fermentation has but juſt begun; becauſe the firſt does not ſeparate like the other and it remains floating in the water, the colour of which is ſometimes of a pale yellow, of a dirty green, and oftener bluiſh. He will further perceive, upon the ſurface of the proof cup, a kind of bead, which by uniting forms a half circle like a rainbow, and alſo a thin pellicle or whitiſh ſcum upon the vat; which is a proof of exceſs. It is true that the bead in like manner ſhews itſelf in the cup or the vat when the juices of the plant have been injured by continual rains, or when the herb is too mature, which always happens when left to run to ſeed; but theſe beads does not touch each other as thoſe of a vat in which the putrefaction is juſt begun.

From all this it ought to be inferred that the artiſt ſhould be particularly attentive to the good quality and cleanneſs of the water, to regulate the fermentation of the firſt vat, when filled with an herb, ſuch as we have deſcribed at the beginning of this article; without much minding the ſmallneſs of the grain, provided it ſinks well, and that he takes care to conform the beating which is given to it afterwards with every poſſible

circumſpection. It is in the *battery* where he will perceive and correct the default; upon which he will judge of the neceſſary time of fermentation for the herb of the enſuing vat, and of the quality of the grain he ought to expect from it, and ſo to the next vat, improving in all probability ſucceſſively, if he duly attends, to the indications of the preceding vats.

THESE explanations are ſo much the more intereſting, that many perſons riſk the loſs of the firſt ſteep, (which is as it were the baſis of the whole crop) to inſure the ſucceſs of all the ſucceeding vats in ſteep. If this ſucceeds, the proceſs with the others will become eaſy, provided the weather holds up fair; but if it ſhould be rainy, it will be a circumſtance the more for haſtening the fermentation. I ought not to omit, at the ſequel of the circumſtances that precede and occaſion a ſhorter fermentation, the ravage done by caterpillars: it is quite natural that an herb ſtript of the half of its foliage, ferments leſs than one well furniſhed with leaves, and that a vat into which numbers of thoſe inſects are unavoidably thrown, very ſoon tends to putrefaction. However, we do not neglect to make the moſt of them, by arranging them as much as poſſible beneath the good herb, and thus, they ſometimes produce good Indigo. But you are to expect, that by ever ſo little delay in drawing off a vat of the like herb, it will ſonn throw up, on the ſurface, a dirty ſcum or pellicle which indicates the approaching ceſſation of the union of the grain; therefore it is neceſſary to ſtop the fermentation in good time, and to take care not to confound the pellicle or ſcum of the proof cup and of the vat, with that of a good herb over fermented, or that of a plant cut when in ſeed, nor of another in ſhort that hath no ſubſtance.

HAVING mentioned the cauſes which determine a quick and inſenſible fermentation, as well as the method to avoid the illuſions and the inconveniencies attendant, it is neceſſary to enter into the detail of a circumſtance foreign to the quality of the Indigo, but which

which can nevertheleſs conſiderably derange and retard the fermentation. I mean to ſpeak of the vats.

THE coolneſs of freſh, or new vats, and perhaps alſo the action of the lime or chunam, conſiderably ſlackens the fermentation of the firſt Indigo that is put into them. Sometimes its effervescence does not appear before forty-eight hours, whereas the ſecond requires but twenty. Vats, that have not been made uſe of for ſeveral years, produce nearly the ſame effect; you may even always perceive ſome difference in that reſpect with the vats that are generally made uſe of, when they have been left unemployed for ſome time. This delay of fermentation, cauſed by the vats, merits ſo much the more attention, becauſe it is often met with at the firſt cut of the herb, of which the natural prompt and inſenſible diſſolution is entirely contradictory to the former circumſtance. In this caſe it is far better to retrench a few hours, than to give one too much, becauſe if you loſe any quantity in the matter, you are at leaſt indemnified by the quality, which will not ſuffer by it, if nothing elſe has been neglected in the proceſs; and therefore you ſhould keep to the firſt grain that ſhall appear capable of bearing the ſtroke of the bucket, which on all ſuch occaſions muſt be managed with prudence.

AMONGST the numerous circumſtances which moſt commonly retard the fermentation, are thoſe of the coolneſs of the water with which the vat is filled, and of the air during the time it works. But as we have fully treated upon the effects of this laſt cauſe, in the preamble which precedes this chapter, the reader can have recourſe thereto. We will here only treat upon the coolneſs of the water, which in a great meaſure greatly depends upon that of the air. It is evident that the colder the water is, the longer the fermentation will be ſuſpended; and therefore, thoſe who can afford the expence of a reſervoir for expoſing the water in the ſun for twenty four hours before it is wanted, ſeldom neglect to employ a means ſo proper to expedite the progreſs of the fermentation.

This

This method is productive of two advantages. The firſt is, that of gaining near two or three hours upon thoſe who fill their vats by hand, juſt at the time they are wanted.

The ſecond is, that you procure more Indigo, by the fermentation of the herb taking place, generally, and at one time. But when a vat has been heated by one or two ſteepings, and ſtrengthened by the ſeaſoning which the matter affords it, it gets into a natural train; the ſecond ſteep is more prompt and thoſe that follow encreaſe, to a certain point. On this account the artiſt ought to viſit the ſecond vat in good time, ſo as to be preſent before it ſhould have paſſed; for if he arrives after the grain has had time to diſſolve, he will find it very much to reſemble the grain of the preceding vat, which had not really formed at the ſame hour, and will fall into the miſtake of which we have before mentioned, by ſtill waiting in hopes of a favourable change. On a ſecend viſit he will be ſurpriſed to find the ſame kind of grain, if it is not worſe: in this perplexity, if he ventures to allow it ſome hours more, he ſpoils the whole. The worſt of this error is, that when he has perceived it, he cannot tell at what time the vat fell into an *exceſs*, nor in how many hours it has exceeded; an information of material conſequence for managing the third vat. A perſon who has committed two ſucceſſive faults, ought never to heſitate aſking the advice of another; although to a man that may not be of ſo much experience, nor ſo able as himſelf, yet he may be able to put him right, becauſe ſuch advice is given with coolneſs, and the artiſt who has committed two conſecutive miſtakes is not diſpoſed either to think or act ſo. The viſits ought to be timely made; but they ought not to be repeated too ſoon after each other: for by ſo doing you would perceive very little change. Therefore, if after the viſit to a vat, you preſume that it has ſtill ten hours to to run, and that you go to it twice thereafter at an interval of four hours each, you will moſt undoubtedly know what to depend upon at the third viſit. Should not the difference be better diſtinguiſhed thus, than if no reaſonable time had been fixed upon for making the viſits? if at the laſt time the vat is by chance paſſed or excceded, it is not difficult to perceive it by the remarks we have before made in this caſe.

ART.

ARTICLE II.—Let us now ſuppoſe that the artiſt works upon a plant that has benefitted from the moſt favorable circumſtances; ſuch as fine weather, warmth, ſmall ſhowers of rain, good ſoil and well ſituated, few caterpillars, and very few accidents, conſequently upon a plant of ſubſtance and full of juice. In ſuch caſe the fermentation becomes neceſſarily very long becauſe it requires a great deal of time for the water to penetrate the herb and develope all the parts; and very violent from the abundance of juices it puts into action.

THE heat of the vat and the conſiderable ſcum with which it is covered, the bigneſs and the roundneſs of the grain, are the ſigns and proof of the abundance and ſtrength of the principles, and of their diſpoſition to unite perfectly.

As ſoon as the fermentation has brought the grain to that point, the water is clean and of a clear yellow colour, like that of Coignac brandy; at other times it is ruddy, or of a clear greeniſh yellow, but you muſt not obſtinately fix upon having any particular colour, eſpecially the yellow or gilt, which you ſeldom meet with at the firſt and laſt cutting of the plant. It is ſufficient that the water be clean and clear, and that the grain ſeparates well from it, when it ſinks to the bottom of the proof cup. You will take notice that when the water inclines to be ruddy, it takes and keeps that colour after, as well as before the time of the juſt fermentation; but in general it is a good ſign: the fecula drains well, becauſe the quality of that water is proper for forming a good grain, and the good grain a fine Indigo.

THE manufacture of the like Indigo offers nothing difficult, and the artiſt muſt be little verſed in the profeſſion, to fail in a vat, ſo long as things remain in the ſame ſtate; but if the weather changes, the proceſs will alſo change. You are not to be ſurpriſed that three days of rain, will cauſe a difference of two or three hours leſs, on the fermentation: if on the contrary the fine weather continues, the fermentation will be rather longer. We ought to obſerve upon this ſubject that two or three hours of fermentation have no

other effect in fine weather, upon an herb of a good body, than one hour upon an herb of little ſubſtance in variable weather.

WHAT we have already ſaid in the preceding article reſpecting the ſigns and defects of a fermentation too weak or too ſtrong, of an herb of good or weak quality, is ſufficient without making a repetition; we therefore refer the reader to it, and paſs the examination of an herb which by its nature requires an intermediate fermentation, between thoſe of the two firſt articles.

ARTICLE III.—THE herb that has ſuffered long drought, above all upon elevated or ſandy lands, wanting ſubſtance, furniſhes only a poor and faded foliage for fermentation. On that account the water eaſily diſſolves it, and the fermentation is not ſo long as the preceding one, unleſs it be in cold dry weather, and then it is always as we before ſaid, a great deal ſlower.

THE ſigns which accmpany this fermentation are alſo by far leſs violent; this kind of vat is ſubject to throw up a filthy ſcum; the grain is badly formed, and ſhows itſelf long and pointed, although that form is not a circumſtance of courſe. Conſequently the produce from ſuch herb is very ſmall, and it often happens that by prolonging the fermentation of it, in order to procure more, it approaches too near to putrefaction, from whence reſults the diſſolution of the grain, a ſediment which will not drain, and filthy juices, common ſigns of putrefaction.

THE herb faded or not cut in time, is yet more difficult, particularly the *baſtard Indigo* that has been left to ſeed. For, to bring it, to its true degree of fermentation, and derive any advantage, requires great heats and much experience and ſcience; without which you are expoſed to uſeleſs labour.

WE cannot diſpenſe with adding to this chapter, the manner in which we ſhould act, when a vat has been filled in the day time, and ought to be beat during the night.

As

As it is very fatiguing to be kept awake for the moſt part of the night, at the riſk of contracting the moſt dangerous diſeaſes by the exhalation from the vats; and and beſides that you cannot depend with certainty upon the examination of the water, which appears blue by candle light; whereas, it is green, and the grain ſcarcely diſtinct; you ought to ſound your vat before ſun-ſet, and upon a compariſon of its water with that of the preceding vat, examined at the ſame period of ſteeping, you will be able to determine upon the time you can ſtill allow it.

But if it ſhould happen to be the firſt vat in ſteep, you muſt calculate the duration by the changes the fermentation has produced until that moment; after which you have nothing elſe to do but conſult your watch, and to order the vat to be drawn off a little before the hour you ſuppoſe it would be perfect, and ſo with the following vats, in the ſame caſe, experience hath taught that this method is preferable to that of watching the vat, with the equal riſk of loſing it. But to avoid all other inconvenience, you ought to reſerve the beating of it till next morning, becauſe the extract would improve during that interval, and you are better able by day light to treat it properly.

May it not be ſaid before we finiſh this chapter, that frequently, the more ſimple and eaſy the object is to be obtained, the more we neglect to employ the means. In effect, we attend to indications for the moſt part of the time very doubtful, to form a judgement upon the moſt important point of the fermentation; whilſt by the aid of a thermometer ſuſpended in the vat, we could acquire a very exact knowledge of the progreſs and of the decline of the fermentation, and which would ſerve as a guide for every quality of herb, and every temperature of the ſeaſon, if to this ſmall expence was added another themometer, and a barometer in particular, to obſerve the degree of exterior heat and the variations of the atmoſphere by them, both which have a great an influence over the operation: at the ſame time not neglecting the due attention to the other ſigns and remarks, for, too many precautions cannot be taken to ſecure a property which is ſo liable to be loſt by ſo many and various accidents.

CHAP.

PATENT OFFICE LIBRARY

CHAPTER VI.

Of the beating or agitation of Indigo.

THE *beating* is the moſt nice operation of all, in the manufacture of Indigo. To give all the light which this intereſting ſubject is ſuſceptible of, and to render the knowledge more eaſy, we will expoſe in the exacteſt order we poſſibly can, the moſt eſſential inſtructions concerning the practice, which form in a manner regular rules for the exerciſe of this art.

WHEN the fermentation and the beating have been carried on to their proper degree, the yellow colour is not confounded with the blue. Therefore it is eaſy to know if theſe proceſſes have been well executed, by the amber colour of the water, more or leſs yellow, bordering ſometimes, though ever ſo little upon green, and always clear; but a bad vat never produces a fine water; and the more it appears troubled, and loaded with a brown or blue colour, the more it is to be ſuſpected, that the fermentation or the beating has been exceeded.

THE ſcum of a vat that has not fermented enough, is greeniſh, ſparkling, but ſometimes very thick, quickly ſubſiding by the ſprinkling of oil, but it returns again very promptly. That, of which the fermentation is perfect, and has not yet been ſufficiently agitated, is of a violet colour at the corners of the vat, light, ſonorous at the ſtrokes of the buckets, and inſtantly diſappears at the touch of the oil; but after it has thus entirely diſappeared, it will again riſe and reſiſt the effects of the oil; a ſure ſign that you muſt ſtop the beating.

THE vats that froth much, and of which the thick ſcum does not entirely yield at the aſperſion of the oil, and alſo of which the parts that adhere to the corners are of a ſky blue colour, denote the putrefaction.

THE exceſs of putrefaction is always diſtinguiſhed by a wide and flat grain, which remains floating between two waters, and does not ſink well to the bottom. The grain takes different forms, according to the difference of ſeaſons and weather: the rainy weather occaſions it to form in ſmall open flat grain; the favourable weather, a round grain like that of ſand; dry weather, a lengthened and pointed grain. The artiſt ought to be careful not to confound the ſmall, flat and open grain proceeding from the quality natural to the herb, with that, which the defect or the exceſs of fermentation of a good herb, renders nearly of the ſame form; for if by miſtake he attributes the weakneſs or natural ſmallneſs of that grain to one or the other of thoſe accidental circumſtances, he runs the riſk, by being too ſparing of the beating, (as he would for an herb over fermented), of not reaping all the advantage he might; and by forcing the battery as if it wanted fermentation, of loſing the vat totally, or of impairing the produce conſiderably,

THE manufacturer will again obſerve that every diſſolution of the grain, principally that which is cauſed by an exceſs of beating, always occaſions a blackiſh or ſlatiſh coloured ſcum upon the bags into which the matter is put to drain, and that the putrid diſſolution declares itſelf upon the vat after the beating, by a whitiſh pellicle of a leady gloſs, which keeps with and covers the fecula in the bags, of which it ſtops the paſſages with a ſimilar plaiſter or lay. Thus he will in general look upon the ſcum or filth of a brown ſlaty colour, as the effects of a grain diſſolved by too much beating, and the pellicle of a whitiſh or lead colour, as proceeding from an exceſs of fermentaion. Now, as the putrefaction not only takes place by letting the herb remain in ſteep too long, but alſo during the courſe of too much beating, which at leaſt produces the ſame effect,

it is not to be uncommon to ſee the bags of a vat over beat, covered with a ſlaty ſcum intermixed with veins of a lead colour.

THE pellicle which is produced upon the battery, does not otherwiſe announce the putrefaction, but when, ſome time after the beating, it divides into ſmall pieces, which are called *curds*.

SOMETIMES when the bags into which the matter is put to drain, becomes covered with a kind of plaiſter of a coppery colour, it is attributed to the want of fermentation or of beating; but it is only thoſe who are experienced that can diſcover the cauſe of this hue, unleſs when the copper hue is intermixed with lead or ſlate coloured veins; all theſe ſigns, and above all the laſt, being very doubtful and uncertain, becauſe the indication from the lead coloured ſcum is ſubject to many exceptions, of which we ſhall ſpeak as occaſion offers. Slack Indigo, that is to ſay, without any conſiſtence, after being put in the boxes, proves alſo an imperfection either in the fermentation or the beating.

THE defect of Indigo, which becomes friable, or breaks eaſily when dry, proceeds (though otherwiſe the quality of it be not bad) from the crop of an herb which was not ripe enough, or the weakneſs of the beating of a vat of herb that had not fermented enough; but the paſte of Indigo when quite black, or of a ſlaty colour ſpotted with white, and of a grain not connected, always denotes an exceſs of fermentation or of beating.

THE artiſt ſhould hold it for an invariable maxim, that if the nerb has already fermented a little too much, he ought to be careful and ſparing of the beating, but if it has not fermented enough he ought to encreaſe the beating; and that if the vat is at its juſt point, he ought not to force it.

HE

He ſhould further obſerve, that the beating is not only regulated by the fermentation, but alſo by the quality of the herb. So that, although it is proper in general to force the beating of an herb that has not fermented enough, he ought however to ſpare it a little if the herb has been weakened by rains or the humidity of the ſoil. He will follow the ſame rule with an herb that has ſuffered too much drought, keeping a medium between that of a good herb, and an herb that has ſuffered too much rain; in ſhort he will conclude that, excepting the rules which are proper for thoſe kind of particular caſes, he ought in general to conform the beating to the fermentation; that is to ſay, if an herb is of a quality to require a long fermentation, the artiſt ought in like manner to give it a long beating, although it had gone through the juſt fermentation it had need of. He ſhould alſo act proportionably with reſpect to that which requires a ſhorter digeſtion. We ought on this occaſion to repeat, that the ſtronger the heats are, the ſtronger wi l be the body and ſubſtance of the herb, and that the length of time it may remain in ſteep on account of its quality, ought not to be miſtaken and ſuppoſed to be cauſed by the coolneſs of the air, the continuation of which inſenſibly weakens the body of the plant,and in ſuch caſe requires leſs beating, although it remains in the ſteeping vat as long a as the other; but if each of thoſe plants are equal in ſubſtance, it is evident that the laſt ought to remain longer in the the vat, although the beating you give them muſt be equal

This evident connexion of the beating to the fermentation and to the quality of the herb, occaſions different combinations, and conſequently divers treatments, the detail of which engages us to divide this chapter into three articles.

In the firſt we will ſuppoſe three vats taken at their juſt point of fermentation, the firſt of which ſhall contain an herb of good growth; the ſecond, an herb injured by the rains, and the third injured by the drought. We will add to theſe the particular ſigns in the *battery*, neceſſary to be known in theſe different circumſtances, and the beating that ſuits them.

We

We will deſcribe in the ſecond article, three vats of herbs of the ſame quality above-mentioned, but which have neither of them fermented enough.

We will then explain in the third article, the ſame objects relatively to a fermentation a little exceeded, or juſt entered into *putrefaction*.

ARTICLE FIRST.

Of the beating a herb that has fermented well.

THE artiſt who treats a vat of good herb taken at the juſt degree of fermentation, ſhould be well upon his guard not to force the beating; for if he exceeds in this point, though ever ſo little, he deprives the Indigo of its brilliancy. The means of avoiding this exceſs, is to obſerve exactly, when, the grains begin to be of the proper bigneſs, or that the diſperſed parts begin to unite and to form into ſmall maſſes; it is then that he ought to examine the effect of the *refinement*, or the dimunition which the agitation of the buckets occaſions in them: becauſe ſhortly after their greateſt collection, they ſpread out into a different form and volume; in the proof cup he will perceive the grain to contract, become round and heavy, ſinking naturally to the bottom of it, where it rolls like fine ſand, and diſtinctly diſengages itſelf from the liquor, which ought then to appear clear and clean: the fineſt particles of the grain cover the bottom of the cup, and endeavour, when inclined on one ſide, to unite with the larger ones, leaving the other ſide very clean and without ſcum; this experiment is called, *making the proof*. The proof is alſo made in another manner; that is, by taking a cup about half filled with the prepared extract, incline it as before directed, and then put your thumb into the ſhallow part of the liquor; if the water riſes ſuddenly on the borders of that ſide, it is a certain ſign of a ſucceſsful vat. The ſame effect will clearly appear if you bear down your thumb firmly to the bottom of the cup.

The ſcum enters alſo into the claſs of indications. In effect, when the herb is well fermented and well beat, the ſcum which participates of the qualities of the extract, is light, lively, full of large ſparkling bubbles; and when oil is ſprinkled upon them, during the courſe of the beating, it immediately diſperſes that ſcum, with a kind of ſimmering very eaſy to be diſtinguiſhed and heard at a ſmall diſtance. In ſhort it naturally diſappears of itſelf, when the beating having been conducted to its perfection and the vat is left quiet. If on the contrary, in half or in one hour after you have ceaſed beating, there remains a ſmall rim or ſcum all round the borders of the vat, it is a ſign the herb had not fermented enough. But if the beating is forced when it is perfect, you detach the lighteſt part of the grain, and break thoſe that have only juſt united. From the diviſion of the firſt the reſult si, a light grain which remains floating in the water, and runs off to a pure loſs; and from the diviſion of the ſecond, a ſediment which fills the intervals of the the large grain, and prevents its refining both in the vat and in the bags, of which laſt it ſtops the iſſues by covering or plaiſtering the outſides of them with a ſlaty coloured mud, which is not to be ſeen upon thoſe of a vat properly fermented and beat, becauſe the bags are always dry and clean. Hence it happens that a box of liquid fecula that before its acquiring its conſiſtance, ſuffers all the inconveniencies of which we have ſpoken at the end of the deſcription of the handicraft, diminiſhes in one half, and after all produces an Indigo of little value.

So that it is better to err by too little than by too much beating, becauſe if that defect cauſes a diminution of the quantity, the quality of the remainder will make it eſteemed, and paſs among the beſt; beſides, there is a remedy for the default, as we ſhall deſcribe at the end of this chapter.

If the artiſt, treats a vat of herb, that grew upon damp grounds, and has been lucky enough to meet the juſt point of fermentation, he ought greatly to diminiſh the beating

of this, from the preceding one, for fear of altering and of deſtroying the feeble union of its grain; as for the reſt he muſt recollect what we have ſaid in the introduction to this chapter reſpecting the natural reſemblance the ſmall grain of this herb has, with that of a good herb too much or too little fermented; and he will ſtop the beating the moment he perceives the grain formed and the water clean. If he works upon a plant that has ſuffered too much drought, or that the crop had been made too late, and ſucceeds in bringing it to a juſt fermentation, he muſt moderate the beating, as we have already ſaid, in order to aſſiſt the feeble union of an impoveriſhed grain, which he will in general find of a lengthened and rather pointed form: beſides he muſt take notice of the indications before mentioned, for diſcontinuing the beating.

ARTICLE SECOND.

Of beating a herb that has not fermented enough.

THE fear of exceeding the fermentation, is the cauſe that the juſt point is rarely attained; it is eaſy to know this caſe by the ſcum of the *battery*, which is green, and moſt commonly light, ſometimes however very thick, but it diſappears inſtantly when oil is ſprinkled upon it. This ſcum is apt to return again immediately, and it often remains in the corners of the vat, where it appears of a deep violet colour; but you muſt not be uneaſy about this, or be led into the idea of the weakneſs of the grain, and thereby be ſparing of the beating, becauſe in appearance it gives a ſuſpicion of an exceſs of fermentation; you ought on the contrary, if the herb is of a good quality, ſometimes to force it, until the ſcum entirely diſappears, and another grain preſents itſelf well formed and the water very clear. That water is then moſt frequently of a clear green, or of a ruddy colour like that of beer, darker in proportion as the fermentation had been weak: beſides, the bags in which the matter is drained will be clean. But if on account of its weakneſs, you ſpare this ſmall wandering grain, which requires but one aſſiſtance to free

it

it from the obſtacles which oppoſed its joining into larger bodies, this default in the preparation will occaſion the loſs of a quantity of the unformed principles, that will run off when the vat is drawn; an imperfection in the union of the grain, which will render the ſediment very difficult to drain; and the Indigo it will produce, friable at the leaſt touch; a defect to which the fecula of an herb is ſubject to, that has not ſteeped enough, nor the extract ſufficiently beat. You will perceive after the beating, a green water which proceeds from the juices that have been left in their natural ſtate, on account of the feebleneſs of that operation, and the bags will be covered with a copper colour. This laſt indication ſerves to diſcover if the green water of the vat proceeds from the management of the beating, or from an exceſs of fermentation; and is of material conſequence for regulating the enſuing *battery*.

If on account of low moiſt lands, of a rainy ſeaſon, you come to work upon a herb, of which the quality gives room to ſuſpect an inſenſible diſſolution, and obliges you to check the fermentation, the feeble obſtacles that oppoſe the union of the parts are ſoon diſſipated; and the grain which by the quality of the herb is naturally ſmall, does not delay forming itſelf. Theſe two circumſtances which may allow us to preſume that it is not yet at its perfection, are often the cauſe that the beating is exceeded, although it was already perfect. But the inconveniences ariſing from this miſtake are prevented by viſiting the vats in good time, and ceaſing to beat them as ſoon as the grain is ſufficiently formed, that the water ſeparates clean from it, and above all, when it is perceived the ſcum reſiſts the aſperſion of the oil.

When you are to beat a vat of herb ravaged by worms or catterpillars, of which you may have retrenched one or two hours of the fermentation, through the fear of ſpoiling the quality, you muſt be ſparing of the beating alſo, and to take great care not to *refine* the grain too much, becauſe the dirt it throws up in the *ſteeping vat* announces

nounces a ready diſpoſition to a putrid diſſolution, with all the concomitant inconveniences. The bags of this Indigo will be of a copper colour, in the like manner as thoſe of all vats which have wanted either fermentation or beating.

In ſhort if the beating of a vat of herb that has ſuffered too long a drought, is in queſtion, or that, which has been left beyond its time before it was cut, and of which the maceration has been prematurely ſtopt, the beating of it ſhould be reaſonably forced, and the uſual ſigns will ſerve as a rule for its continuation.

ARTICLE THIRD.

The beating a herb in fine weather, the diſſolution of which, having exceeded in one or two hours.

IT is of importance not to confound the flat and confuſed grain of a vat of good herb that has over fermented, with that of an herb that has not fermented enough, or of a herb of bad quality, although well fermented; or again of a vat over beat. You will know the ſtate and defect of the vat we ſpeak of, by its greaſy and thick ſcum, which the aſperſion of oil upon it, ſcarcely diminiſhes, and by the ſcum which collects in the corners of the battery, of a ſky blue colour, by its widened grain that forms much quicker than ordinary, and alſo hy its water more or leſs charged with blue, which co'our cannot, either in the proof cup or the vat, even after the beating, clarify, and ſeparate itſe'f like that of a good vat, and becomes darker more and more, ſo long as this proceſs is continued. Upon theſe remarks ſure proofs of its ſucceſs; and upon the conformity the vat may have with theſe ſigns, the artiſt ought to take every precaution, and proportion the time of beating in conſequence. This i wha the ſhould obſerve the moment the grain takes its proper ſize: he muſt not quit his proof cup, becauſe every ſtroke of the buckets makes an impreſſion upon the extract. The moment he finds the grain paſſable round, he ought to ceaſe beating, without endeavouring

vouring to *refine* or contract the union of its parts. When it is arrived at this ſtate he will find that the water in the proof cup viſibly becomes brown, as it repoſes; and yet it will be green and brown in the vat, excepting the ſurface, upon which it forms into a kind of cream or ſcum, that covers it for ſome hours after it has ſettled, and then divides into pieces, which are called *curds*. It is that *curd* which produces the lead coloured layer, upon the bags, and ought here to be attributed to the diſſolution of the parts, occaſioned by an exceſs of fermentation, of which the effect is, the filling up of all the intervals between the beſt formed grains, and of preventing them thereby from draining well: therefore on all ſuch occaſions you ſhould endeavour to take off, as much as poſſible that dirt or filth, with feathers, fern, or in any other convenient manner. In ſpite of theſe precautions, and the good quality of the herb, you may often get but a dull, or a ſlaty coloured Indigo, and of a bad conſiſtence. That filth or cruſt upon the bags denotes an exceſs of fermntation, of one, and even two or three hours, if it happens in the fine ſeaſon, when the herb producing a greater quantity of ſpirits, the action of the other principles which tend to a complete putrefaction, is ſuſpended for a longer time.

The water that appears brown after beating, is a certain proof of putrefaction. There is yet a kind of putrefaction of which the ſigns are different from theſe: you find after the beating a light red water *(claret coloured)*; it is ſometimes difficult to perceive its defects: the water remains clear and without filth. Theſe kind of vats froth much, and are eaſy to beat, becauſe the grain forms promptly; but the matter is difficult to drain.

If you have to treat an herb of a weak quality, already got into putrefaction, it will be rarely in a fit ſtate to ſupport the beating; ſo that it will have no force, or if of any, the leaſt of all, and the Indigo got from ſuch a vat will be of the very worſt quality.

If the herb is of that kind, which has ſuffered much drought, or of which the cutting has been delayed too long, and has been left to get ſlightly into putrefaction, you ſhould manage the beating very cautiouſly.

Notwithstanding all the care taken, you muſt not expect any thing good from thoſe ſort of vats. If however the putrefaction has only exceeded in one or two hours in fine weather, this fault will only occaſion the loſs of a few pounds of Indigo, and its quality will ſuffer very little by it.

It muſt be perceived after all we have ſaid in the foregoing part of this work, how very important it is not to miſtake and confound the ſigns or indications, ſo as not to diminiſh or increaſe the beating inſtead of the fermentation, or the fermentation inſtead of the beating, and in order alſo, to judge aright of caſes in which you ought to recommence this laſt operation. A perſon may find himſelf obliged to recommence the beating of a vat which he had been fearful at firſt to carry on, either becauſe he had wrongly ſuſpected his herb to be over fermented, when at the ſame time it is not enough ſo, and from the want of the neceſſary beating the grain delayed its appearance; or becauſe it had appeared of a weakneſs or in ſuch a troubled ſtate, as to make him ſuppoſe that it had already ſuffered too much by the beating: in theſe doubts, he can very well ſuſpend the beating, and leave the matter to reſt for one or two hours, when the quality of the water will eaſily clear them up. If after that time, in which the fermentation perfectionates, you remark the water coloured with green, and a ſmall line of ſcum all round the vat, like that of water juſt beginning to boil, it is proper to recommence the beating: ſhortly after a new grain appears much bigger than the firſt; but as it is flat and unformed in the beginning, you refine, and it becomes round in the courſe of beating. The water of whatever colour it may then be, ſeparates from it clean and clear, and the grain will drain well. However this practice

ſhould

ſhould not be uſed but when you perceive the water to be green bordering upon yellow, or of a ruddy colour, which will be the darker in proportion as the degree of fermentation has been weak. But as this laſt colour is a good ſign, is ſometimes met with in the moſt perfect fermentation, and even in certain circumſtances with the putrefaction, the manufacturers muſt recollect if he perceived a light ſcum upon the vat during the proceſs of beating, and if it entirely diſappeared neat upon ceaſing to beat. Theſe, and the other remarks upon the unformed and diſperſed grain, ſhew the neceſſity of a ſecond beating; but one ought not to loſe this firſt grain in ſearch of a ſecond, if, after time allowed for it to repoſe, the water appears of a bluiſh brown upon a green ground: theſe colours announce an exceſs of fermentation, and the neceſſity of the feeble beating it has received, to which we ought to confine ourſelves; becauſe the blue colour diffuſed in the vat, proceeds from part of the grain being too much weakened by the fermentation, and diſſolved by the beating: which requires a cautious management of it. The green colour proves that the putrefaction and the beating are not accompliſhed, ſince there muſt ſtill exiſt juices that would not retain that colour if the putrefaction was exceſſive, or if by a beating ſuitable to their quality they hadacquired the form of grain.

It is not at all ſurpriſing, conſidering the multiplicity of obſtacles, that the moſt ſkilful manufacturers ſhould ſometimes fail, and with much greater reaſon thoſe who have not ſo much knowledge, and therefore two means have been deviſed by ſome perſons to prevent the entire loſs of their labour, whenever they may have erred either in the proceſs of the fermentation or the beating.

The firſt is to put back all the water of a vat over-beat into the next vat of herb for ſteep, in hopes of rendering the produce of the herb more conſiderable. I am not acquainted if the experiment was ever ſucceſsful; but I preſume it has been productive of no good, and I think one ought never to riſk ſpoiling a ſecond vat in hopes of repairing the loſs of the firſt.

The other is, to run off all the troubled water, to the level of the firſt plug hole of the battery; and when this is done they keep the remainder which is always much thicker, pour it into boilers placed over fires, where they let the greateſt part of it evaporate. When this matter, which exhales a very diſagreeable ſmell, is thickened a little, they put it into bags, that at firſt yield a very ruddy water; after twenty-four hours they ſpread it in the boxes, without its having loſt much of its fluidity: then, being expoſed to the ſun for ſome days, it will crack as mud, but they are careful to join it, with the trowal as before mentioned; finally, they cut it into ſquares, which becomes ſo hard, that it is almoſt impoſſible to break them with the hand; and the interior part is of a deep black colour.

This produce, after all the pains and labour appears ſo bad and is ſo unprofitable, that moſt perſons who fail in one vat, prefer running it off immediately: the infection which a vat over-rotted naturally ſpreads, during the laſt mentioned proceſs ought to leave no regret to any one for having ſo done.

CHAP.

PATENT OFFICE LIBRARY

CHAPTER VII.

Of the Buildings, Veſſels and Utenſils.

BY the term, *Indigo manufactory*, ſhould be underſtood generally the land upon which Indigo is cultivated; the buildings, veſſels, labourers and utenſils proper for carrying on the manufacture. In this laſt acceptation a ſingle manufactory ſhould be compoſed of three veſſels adjoining one to the other, with partition walls. We will here ſuppoſe, that the veſſels or vats are of maſon work, although we know that in ſome countries, they are made of wood: which muſt neceſſarily occaſion ſome difference in the diſpoſition of them, and of which we ſhall hereafter ſpeak. Theſe three veſſels are built in gradation, and in ſuch manner as that the water drawn out of the firſt, falls through the plug holes or cocks into the ſecond; from the ſecond, into the third, and from the third run quite out.

THE firſt of theſe veſſels, is called the *ſteeping vat*. Into this the herb is put, and there left to ferment and macerate.

THE ſecond veſſel, is called the *battery or beating vat*, becauſe the extract from the firſt vat is let into it, after undergoing the fermentation; there, to be beat, and otherwiſe treated as may be found neceſſary.

THE third veſſel, which forms but a kind of encloſure, is called the *repoſer*; the bottom of this veſſel preſents a plane in its greateſt ſpace; but towards one of the ſides of this plane there is a ſmall baſon called the *receptable*.

THE *receptacle*, hollowed in the plane of the *repoſer*, is a ſmall veſſel, meant particularly to receive the fecula or ſediment drawn out of the *battery*. It ought to be hollowed below the level of the plane of the *repoſer*, and in ſuch manner as to touch the wall of the *battery*. They commonly place it right at the middle of that ſide, ſometimes at one of the corners, but always on that ſide next to the *battery*. It is provided with a ſmall border, in order to prevent the water, that may remain at the bottom of the *repoſer* from returning into it.

WHAT we have above ſaid reſpecting the three neceſſary veſſels, only relates to ſingle and detached buildings; becauſe when it is convenient to build ſeveral *ſteeping vats* adjoining to each other, you diminiſh the number of *battery vats* by one half, and conſequently the *repoſers*. In all large manufactories the economy of this diſpoſition will be found conſiderable.

THE bottoms of theſe three large veſſels are flat, but ſloping about two or three inches, to facilitate the running off, of the water from one into the other.

THE bottom of the *baſon or receptacle*, is of a concave form, the circumference of which may be either round or oval. We ſhould further inform the manufacturer, that at the bottom of the *receptacle* alſo, there ſhould be another ſmall *receptacle* in a round form reſembling that of the inner part of the crown of a hat; it is in that hole, or form, that he finiſhes the drought of the fecula, which naturally ſettles in it.

THE firſt veſſel or vat, ought to have at leaſt one plug hole, of three inches diameter, or proportioned to the ſize of that vat which is called the ſteeping vat.

THE ſecond vat has three plug holes, with plugs perpendicular over the *receptacle*,

of

of about three inches diameter each. Thoſe holes are raiſed at the diſtance of about four inches one above the other; the two uppermoſt ſerve to draw off at two different times, that water, which ſwims on the fecula or ſediment, after the beating proceſs is finiſhed.

THE third hole which is neceſſarily directly over and neareſt the *receptacle or baſon*, is made uſe of, to draw off the fecula which ſettles at the bottom of the *battery*; with which it ſhould be level, and indeed, though but little, a trifle lower.

THE plan of the third veſſel is, that inſtead of a plug hole there ſhould be an opening at the bottom of the outer wall, of about ſix inches ſquare, and which is never ſhut, and lets out the water into the ditch made for carrying it off.

THE *receptacle, or little form within the third veſſel*, has no need of an outlet, becauſe the fecula ſettles in it pretty ſolid, and is taken out from its only aperture.

THE plug hole ſhould be made of an incorruptible wood, and fixed in with the maſon work. The holes are bored through the whole length of the wood, to form ſcuppers. The heighth and breadth of each piece of wood, is proportioned to the diameter of the holes; and the length according to the thickneſs of the wall into which it is fixed, obſerving that the two ends are exactly even with the wall at both ſides. The plugs with which the ſcuppers are ſtopt are round, and of the ſame kind of wood.

WHEN you deſign to build Indigo works, you ſhould above all things examine the place; obſerve if it is poſſible to convey the water of any river or ſtream to the vats; for if you have not this convenience, you muſt indiſpenſably dig wells or make reſervoirs

voirs near and about the place upon which you mean to eſtabliſh your manufactory, without which the fineſt works would become uſeleſs. When you have made ſure of this eſſential point, you may begin your buildings, obſerving the following rules.

A MANUFATORY ſhould be eſtabliſhed upon ſome bank or elevation whether natural or artificial, ſufficiently high to run off the water, and not ſubject to any reflux. But ſometimes there is no other choice than fixing it on a low ſituation, this is partiularly adviſeable if, you can benefit by the water of a river or ſtream for filling your vat. It is ſufficient if the *battery ſcupper holes* can run free during the rainy ſeaſon when the waters are at the higheſt, and remain above the level of the neighbouring river or ſtream.

THEY give the firſt vat, either the form of a perfect ſquare, or that of a ſquare a little long; but which ever may be the form, the borders and the depths are always after the following manner. Theſe are the rules obſerved reſpecting a *ſteeping vat*, of which the opening offers a lengthened ſquare.

IF the firſt vat is ten feet long, the breadth ſhould be of nine, and its depth of three feet, including a ſmall *talus* of about ſix inches high of which the ſlope muſt be entirely within, and forms a kind of border to the vat. When the length is twelve feet the breadth ſhould be of ten, and the depth the ſame as the former, and the reſt in like manner. When the length is of eighteen or twenty feet, they allow ſixteen or eighteen for its breadth, and three and a half or even four feet for the depth. This laſt proportion is much better than that of twenty feet ſquare, obſerving always what we before ſaid with reſpect to the borders; but it is dangerous to make theſe vats too large, becauſe the fermentation cannot be ſo prompt, nor act ſo equal throughout, as in thoſe of a middling ſize; and becauſe the produce of a large vat is much inferior to that of two other vats, which would both together only contain the ſame quantity of herb:

herb: therefore it is generally the cuſtom to confine the proportions, to thoſe vats which contain about forty bundles of herb, that is, about the contents of a vat of the firſt mentioned dimenſions; or of ten feet long and as many broad, which would contain fifty loads.

ALTHOUGH the dimenſion of the ſecond vat has no influence upon the quantity and the quality of the Indigo, it is however neceſſary for the proper management of the beating, to limit its extent and to raiſe the borders conſiderably; but to conſtruct it properly, two eſſential points muſt be attended to, in the execution.

THE firſt is, the level of the bottom of the *ſteeping vat*, which you are ſometimes obliged to keep very low, for the convenience of filling it eaſily.

THE ſecond is, to examine if at three or three and a half feet lower than the level of the bottom of the *ſteeping vat*, you can lay the bottom of the *battery*, ſo that it may have a run of ſix inches above the plane of the third veſſel called the *repoſer*, and that the *repoſer* may have a free eaſy diſcharge into ſome ditch or adjacent marſh; for if it was not poſſible to build according to this manner, it would be neceſſary to raiſe the bottom of the *ſteeping vat* to ſuch a height as to enable you to accompliſh the foregoing plan. When you are ſure that you can conform to theſe rules, you may then decide upon the ſize of your *battery*, which ought always to be one, two or even three feet longer in one way, than in the other; but that extent muſt be regulated by the calculation of the quantity of cubic feet of water, the *ſteeping vat* ought to contain, after it is filled with herb, and that the water is at within ſix inches of its border. To find this, you muſt firſt multiply the number of feet of the vats length, by thoſe of its breadth, and then multiply the product of theſe two, by the number of feet of the vats height, but not including the ſloped edge or border *(talus)* which is of ſix inches. When you have done this ſecond

multiplication and found the product, you muſt ſubtract one third therefrom, as an allowance for the place the herb occupies in the vat; the remaining two thirds are equal to the quantity of cubic feet of water, which the baſon of *the battery* ought to receive, to which you muſt allow ſuch a proportionate dimenſion as that the length multiplied by the breadth, gives a product, which, being multiplied by three or three and a half, of depth, forms a capacity, equal to the quantity of the volume of water, found in the calculation of the *ſteeping vat*.

You muſt then raiſe a maſon work upon the walls of the baſon of the battery, of two feet high to ſerve as a border to that veſſel; this will give it five or five and a half feet height, which is a proper one, above all, when you employ men and buckets to beat the extract in the battery; for the borders are lowered by ſix inches when the buckets are worked by a mill.

As the battery ſhould be longer in one way than in the other, you ſhould obſerve that the narrow ſide ſhould be next the *ſteeping vat* in all *ſingle* manufactories, but when you build ſeveral *ſteeping vats* together and you can work your battery by water or horſe mills, you are neceſſarily obliged to take the contrary direction.

The borders of the ſteeping vat, as we have before ſaid, form a ſlope inward, making the fourth of a ſquare of about ſix inches. The borders of the ſecond vat, have alſo a ſmall talus, but it is not ſo great towards the inſide; thoſe of the *repoſer* are flat. This third veſſel has no fixed ſize; however the partition wall of the *battery*, commonly ſerves for the breadth of the oppoſite ſide of the *repoſer*, and as for the two ſides, ſix or ſeven feet are ſufficient.

The *ſmall baſon or receptacle*, ſloping inward a little, on the ſide which touches the *battery*,

battery, ſhould be two feet deep including the ſecond form within it, and two and a half feet diameter and even more, according to the largneſs of the firſt veſſels. The other interior round form, may be five or ſix inches diameter, and as many deep.

THE height of the walls of the *repoſer* which join to the *battery* ſhould be about three and a half or four feet, reckoning that the bottom of it is ſix inches lower than the *battery's* laſt plug hole. At one of the corners within the *repoſer*, next the ſeparation wall of the *battery*, you ſhould have a flight of ſteps for the convenience of the workmen who take out the ſediment; theſe alſo ſtrengthen the *battery vat*.

THE maſon work of theſe veſſels and particularly the *ſteeping vat*, ought to be built with a great deal of precaution, and with all the ſolidity poſſible; to be perfectly tight and able to reſiſt the violent efforts of the fermentation; on that account the foundation is prepared with a maſonry of dry rocks or ſtones, the intervals well filled up, and the whole beat down, before you lay the bottom of the maſon work and the walls which are built round this foundation. To the *ſteeping vat* they allow for the thickneſs of the wall, fifteen, twenty inches, and even two feet, eſpecially when it is to be twenty feet ſquare; twelve or fifteen inches is ſufficient for the walls of the other veſſels; but the ground work of which we make mention of above, requires to be very good, for fear that any adjacent ſprings or waters which filter in the earth, ſhould ooze through it. A mortar of ſand and lime (chunam) is commonly made uſe of, although in places where lime is extremely ſcarce or dear, clay has been employed with ſucceſs, in works that are expoſed to the open air; but the outer part they always plaiſter with good lime, (chunam,) ſand and mortar, and the inſide with a ciment made as follows.

WHEN all your maſon work is well dry, you muſt plaiſter the interior parts of the vats with a ciment of quick chunam (lime) and pounded brick finely ſifted; you ſhould

be

be careful to poliſh the work as it dries, to preſs the ciment with fine trowels at the ſame time, and prevent any cracks in the plaiſtering.

As the ſmalleſt crack would let out a vat when filled; whenever perceived, you ſhould have it ſtopped, by taking ſea ſhells of any kind and pound them to a fine powder, which ſift, and mix therewith fine ſifted quick lime, and a ſufficient quantity of water to compoſe a firm mortar, with which you muſt diligently fill up the cracks of the vat; this ciment is of ſuch a nature, that it immediately hardens and ſtops the leaks. Others repair the cracks in the following manner; they widen them, and with a compoſition made of equal parts of quick lime, and brick duſt both ſifted, and pounded iron droſs, which ſhould be mixed with as little water as poſſible to ſoften it.

At the Iſland of Mauritius, they diſſolve ſea ſhells in lemon juice, (limes,) which with the whites of eggs make a very excellent maſtic. Many preparations might be propoſed, but as every country has ſome particular ciments, we do not think it very eſſential to ſay more upon this ſubject; for the artiſt, if he has neither time nor convenience to compoſe a maſtic for repairing his vats, may make uſe of the common ciment, which being made very fine, not too thin, and properly applied produces almoſt the ſame effect as other preparations.

Besides, attention ſhould be paid, that a certain quantity of water be always kept in the vats which are to remain unemployed for any time; in order that the exceſſive heat may not damage them.

This work done, a ſhed ſhould be built over the repoſer to ſhelter both the indigo and workmen. Some manufacturers carry the ſhed over the *battery* and even the *ſteeping vat*.

It is certain that it would be advantageous to have the *ſteeping vat* ſheltered from continual rains or violent ſtorms; becauſe the coldneſs and abundance of thoſe waters retard the fermentation and the indications which are to guide the artiſt, to judge of the juſt degree, are troubled; beſides it is not well decided that too much of theopen air, and the extreme heat occaſioned by the rays of the ſun, are the moſt prompt means of exciting the fermentation: therefore we forbear blaming any of thoſe uſages, which do not ſeem to create any very ſenſible difference in the quality of the Indigo; and for that reaſon moſt perſons conſider the covering of the *ſteeping vat* as entirely uſeleſs. You muſt only pay attention, when you are working an open vat in rainy weather, not to put altogether ſo much water into it.

As it is abſolutely neceſſary to prevent the too great dilation of the herb in the *ſteeping vat* of which it will ſoon riſe above the borders, you ſhould fix four ſtakes of incorruptible wood about three feet into the ground; they ſhould be placed at each ſide of the *ſteeping vat*, at the diſtance of one quarter of the length of it from each corner, and of courſe oppoſite each other. Theſe poſts which are called the *keys*, riſe eighteen inches above the top of the vat, have towards their extremity a mortiſe of ſix inches wide and thirteen inches long. Theſe mortiſes are meant to receive bars, which directly traverſe above and the whole breadth of the ſteeping vat from one *key* to the *other*, and at the ſame time *wedges*, that are drove between, to confine the bars in the mortiſes. The bars of the keys ſhould be ſix inches ſquare; ſometimes they are made ſix by eight inches.

When the vat is loaded with the herb, you lay rafters of cocoanut tree or planks upon it pretty cloſe to each other, in all the length of the vat, and acroſs them again, two or three joiſts at equal diſtances. Theſe joiſts or traverſes which bear upon the rafters acroſs the vat, are of ſix inches ſquare, and are kept down in that poſition, by *wedges*, placed between them and the bars of the *keys*.

THAT part of the *keys* which is under ground, ought to be of at leaſt eighteen inches diameter; and that above of from ten to twelve inches ſquare, ſo as to admit of making the mortiſes proportioned to the bars we have above mentioned.

THREE poſts fixed in a triangular poſition at the two ſides of the *battery*, that is to ſay, two at one ſide and one at the center of the other ſide, ſerve as ſtenchions for the poles of the buckets, employed to beat and agitate the extract in that vat. In ſome places they make uſe of four buckets, and then of courſe they make uſe of two ſtanchions on each ſide of the vat, but always in an alternate poſition, as with the three we have been ſpeaking of.

THE bucket is an inſtrument compoſed of four pieces of ſtrong plank, without a bottom, and is fixed to a pole or haft. It reſembles a baker's trough without cover or bottom, ſo that the upper part is much wider than the lower: but the two ſides are vertical: that is to ſay, they do not widen at all. The length of the bucket is from ten to fifteen inches; the breadth of the upper part from nine to ten inches: the lower opening is from three to four inches, and its depth from nine to ten inches; however theſe proportions are very arbitrary. To haft the bucket, you muſt make a mortiſe right in the center of one of the planks that form its length, and another mortiſe in the oppoſite plank, but rather lower than the center, that is, that the ſecond mortiſe muſt be made on the ſide where the bucket begins to cloſe. After which they fix the haft, which is a pole of about the thickneſs of the arm, by paſſing it through the firſt hole, and traverſing the bucket obliquely from one ſide to the other. The outer end of the pole next the bucket, is ſecured by a peg; then they are placed into the crochets made at the head of the ſtanchions which are about breaſt high, and ſecured by an iron peg, ſo that the workmen who play the buckets are enabled to plunge and raiſe them with eaſe.

THE length of the pole from the crotchet in which it reſts, to the bucket, is regula-

ted

ted by the breadth of the battery, diminiſhing it by one foot, in order that the bucket may beat free, and that it may not damage the walls of the vat. It is neceſſary that thoſe who beat the extract with theſe inſtruments, ſhould exactly time it, and give their ſtrokes together, otherwiſe the water will ſplaſh four or five feet above the baſon.

They make uſe of two kinds of mills for agitating the extract: the one is worked by water, and the other by horſes. In the one and the other the motion depends upon an axle laid acroſs the *battery*, the two ends are covered with iron, turning upon iron crotchets fixed at each ſide of the *battery*; the axle is furniſhed with four hafts, ſufficiently long that the bucket fixed at the end of them may fill with water as they are turned round. Theſe buckets ſhould have bottoms and be made to ſeparate from the hafts whenever it is neceſſary; becauſe if the machinery of the mill is made to ſerve ſeveral *batteries*, it would be uſeleſs to have thoſe pieces fixed to the axle, when not in uſe. Some perſons to ſave the expence of the machinery of a mill, ſimply place an axle acroſs the *battery*, furniſhed with ſpattles, to which they give the regular motion, by the means of two winches, one at each end. Upon the ſubject of theſe works, you may conſult the methods of the Indians as mentioned in the article of Aſia.

As the fecula falling into the ſmall *baſon* or *receptacle* is ſtill very watery, they take it from that veſſel and put it to drain, into good common linen bags.

These bags are commonly from one to one and a half feet long, ſquare or pointed at the bottom, and from eight to nine inches broad at the top. Near the mouth of theſe bags ſmall eyelet holes are made, through them a cord is fixed, and the bags hung up by each ſide, to the pegs of a rack fixed within the wall and at the further end of the *repoſer*; When the bags ceaſe to drip, the fecula although ſtill ſoft, is turned out from them into ſhallow boxes, there to dry. The boxes ſhould be of a light ſpungy wood; and of about three feet long, one and a half broad, and two inches deep.

You

You expoſe the boxes upon benches or horſes, part of which ſhould be undercover of the building of the drying houſe, the other in the open air.

These horſes are made with two rows of poſts drove into the ground and at about breaſt high above it, the top is croſſed with laths or bamboos; no particular proportions are given; it is enough that the horſes are ſtrong enough to bear the weight that may be put upon them. As you may have room for ſeveral ranges of horſes in your drying houſe, you muſt obſerve that they ſhould be two feet aſunder from each other, and that there be at leaſt five or ſix inches ſpare ſupport at each end of the caſes.

We can give no particular dimenſions for the ſize of a drying houſe, there being no fixt rule laid down; they are generally built like our cart houſes or granges, one end of which ſhould be open. At the other end of the drying room you ſhould make a ſtore room, to put up the Indigo when it is perfectly dry; the reſt of the building ſerves as a ſhelter for the Indigo you have to dry when it may rain, and to keep the caſes in at night, which ſhould be always done.

PATENT OFFICE LIBRARY

CHAPTER IX.

Method of Planting and Making Indigo in different parts.

ARTICLE FIRST.

Manner of Sowing, of Cultivating, and of extracting the colour of the herb called Indigo, in the Eaſtern countries, near Tſinſai, between the Coaſts of Coromandal and Malabar, by HERBERT de JAGER. *

SOILS that are either too rich or too damp, are not proper for the Indigo plant; becauſe it either grows too quick and is only filledwith a watry ſubſtance, or that it is choaked by weeds. Therefore the ground to be choſen for the cultivation, ſhould be high, and not expoſed to too much rain, nor to the fall of heavy dews. Preference is given to mixed ſoils, of which one part is good earth, and with too parts of ſand: The plant even grows in ſand alone at and near Devenapatam; but it does not thrive ſo well. As ſoon as the rains begin to fall in the month of September, the people till the ground once or twice, and after that, they let it lay by, till December; they then again paſs the plough through it, and on the firſt fine weather they throw the ſeeds into the furrows, and level the ground with harrows. Directly after the firſt convenient weeding, when the herb begins to bloſſom and to go to ſeed, which takes place towards the month of February, and that the leaves begin to turn yellow, they cut it, ſo that there may remain three or four inches to the branches upon the ſtock, by which means they ſprout out with the firſt favorable rains, and at the end of three months furniſh a

* Mêlanges curieux, ou éphémérides de l'acadamie des Curieux de la Nature.

ſecond crop; which being treated as the firſt was, is followed by another crop; and then the plants are left to run to ſeed, theſe ſeeds are dried properly, in order that they may be fit for ſowing the next early ſeaſon. Finally, the plants are burnt, as incapable of reproduction, and the aſhes ſtrown over the ground, being a very good manure.

THE plant is never cut but in fine weather, in order to expoſe it to the ſun and to dry it perfectly, during the hours that its rays are the hotteſt. They afterwards beat it till the leaves quit the ſtalks, they gather them and put them in ſome place ſheltered from the wind, where they remain until the weather is calm enough to admit of expoſing them again to the ſun, the leaves being then perfectly dry, they are pounded and reduced into powder; when in this ſtate it is carried into barns well cloſed on all ſides, covered with hurdles and mats, and kept there for twenty or thirty days. After which time, they are put into cauldrons with either freſh or ſalt water, it being to them a matter of indifference which. They expoſe theſe cauldrons to the greateſt heat of the ſun, that is from ten o'clock in the forenoon until two o'clock in the afternoon. The matter then begins to ſwell, and a light purple ſcum riſes. They filter the colour thro' a very clear cloth. Afterwards they compreſs the leaves ſtrongly with their hands, and again pour water upon them; they repeat this work until the water no longer appears of a green colour. The tinctures thus extracted are beat, nearly in the ſame manner as cream is churned in Europe, until the ſcum, which was at firſt of a light violet colour, becomes quite blue, and that the water is almoſt black. They then let it repoſe for two hours; after that time, they agitate it with a kind of ſpattle, at two or three different times; they cover the vaſe with a cloth, and do no more until the thick matter which is the real Indigo, has ſettled at the bottom. The next day at about eight o'clock in the morning, they ſeparate the water from the ſediment; the water at that time is ruddy. They ſtir the ſediment with their hands for two or three times, and

tranſport

tranſport it to a bed of ſand, ſloping a little from the middle, which they cover with a wet cloth, that had already been expoſed for two or three hours, to the hotteſt rays of the ſun, upon this they ſpread the matter, by which means the water quits the thickeſt parts, the ſurface becomes covered with a thin ſkin of a purple hue, and in order that the matter may receive ſome conſiſtence, they leave it in this ſtate for about two hours, that is to ſay, until it begins to crack. They then take the corners of the cloth, and by meeting them equally, double the thickneſs of the matter; they break it, put it into other vaſes in which they knead it well, firſt dipping their hands into water; then, they make it into cakes, which, being perfectly dried, is ſold and eſteemed in all parts as an Indigo of the firſt quality, and fit for the different uſes of painting and dying in blue.

ARTICLE SECOND.

Manner of Cultivating and Preparing Indigo in Guzzerat, by BALDŒUS. *

THEY ſow their grain in the months of June and July, and make the crop of thoſe in November and December. The largeſt kind grows at *Sarqueſſe*, about ſix miles diſtant from *Amadabad*, the capital of *Guzzerat*. They let their plants ſtand for three years, and make but three crops; after which it is of very little value, and indeed the ſecond and third crops proportionably decreaſe in value, from the firſt. The firſt year the leaves are cut at about one foot above the ground, they put them to dry in the ſun, for twenty-four hours, and thereafter into ſmall veſſels which they fill with ſalt water. They load this mixtion with heavy ſtones and leave it ſo for four or five days, keeping the water always in continual motion; after which they decant it into larger veſſels, where they alſo keep it in agitation, by beating the water without intermiſſion, until it

* Deſcription of the Coaſts of Malabar—Vol. VI. of the European Diſcoveries.

becomes

becomes thick and that the Indigo ſinks to the bottom. They then draw off the water, they ſtrain the matter through a clear cloth, and cover it with hot aſhes, to dry it. The country people adulterate it with oil, and an earth of the ſame colour; the oil is made uſe of that it may float better upon the water.

The proof of the goodneſs of Indigo is, when it is bright and dry; that it floats upon the water; that when burnt, it produces a ſmoak of a violet colour, and leaves very little aſhes. The Indigo which the Guzzerat people call, *Amyel de byant*, comes particularly in the rainy ſeaſon, June, July, Auguſt and September, although an exceſs of rain is very pernicious to the plants. The ground on which that kind of herb grows, ſhould be left fallow every fourth year. Great care muſt be taken to clear the grounds about, from thiſtles, briers, and other weeds; and the purchaſers of Indigo muſt alſo be careful that it is very dry, otherwiſe they may loſe thirty per cent. in the ſpace of eight or nine days.

The Indigo *Laura* or Indigo of *Bayana* is of three different ſorts. The firſt which is called *Vootee*, is of a brilliant blue inclining to violet, when you cruſh a piece of it on your thumb nail, and obſerve it in the ſun. The ſecond is called *Geree*, and is the more eſteemed, if it approaches the violet colour. The third is called *Cateole*, and is the leaſt eſteemed: the colour is of a dark red; and ſo very hard that it is with difficulty you can grind it.

ARTICLE

ARTICLE THIRD.

Deſcription of the culture of Indigo, and of the Manufacture at Sarqueſſe or Garcheſſe near Armadabad, by JOHN ALBERT MANDELSLO. *

THE beſt Indigo in the known world comes from a village near Armadabad, called Sarqueſſe, and is called by that name. It grows in the favourable years to the height of ſix or ſeven feet. The ſeeds of the plant are put in the ground in the month of June, and the crop is made in the months of November and December. They plant it only every fourth year. The firſt year it is cut at about a foot from the ground; the leaves are plucked from the ſtalks, and then put in the ſun to dry; after which they are put into deep ſtone troughs to ciſterns herein they pour ſix or ſeven feet of water; it is ſtirred about from time to time, until the property and colour of the herb is extracted. They then run off the water into another trough, where they leave it the whole night to ſettle. The next morning the water is taken off; what remains at the bottom is drained through a coarſe cloth, and the ſediment put into the ſun to dry; this Indigo is of the beſt quality. But the country people adulterate it with an earth of the ſame colour; and as the goodneſs of this drug is eſtimated by its lightneſs, they add oil to their mixture that it may float on water.

THE ſecond year the foilage comes very well upon the branches which ſprout from the ſtems that were left ſtanding, but the quality of the Indigo is not ſo good as the firſt year. However it is preferred to *Gingey*, that is, to the wild Indigo. The ſecond year they alſo leave a part for ſeed. The herb of the third year is not good; and therefore the produce not being ſought after by foreign merchants, the people of the country employ it to dye their own cloths. The colour of the beſt Indigo inclines to violet; and

* Voyage of J. A. Mandelſlo to the Eaſt Indies.

alſo ſmells like violets when burnt. The Hindoſtans call it *Anil*, and as we before obſerved, leave the ground to lay fallow, the fourth year, always weeding it perfectly, then plough it two or three times before ſowing, and at a convenient time after the growth weed again, and ſo continue this operation until it is cut.

ARTICLE FOURTH.

Deſcription of the culture of Indigo and of its Manufacture in Guzzerat, by VAN TWIST.

Firſt extract from the Amboyna Herbal.

AFTER having gathered the leaves of the firſt crop of Indigo, they expoſe them to the ſun during the heat of the day to dry; and when dry, they are put into ſtone ciſterns or vats, made for that purpoſe: theſe are filled with clear water to about man's height; the people then ſtir and mix the water with the leaves until it has acquired the colour and property of the leaves; when it is well impregnated they let out the extract into another veſſel contiguous to the firſt. This extract is left for the whole night to ſettle, and that it may clarify and ſeparate from the thick matter which naturally ſinks to the bottom. The water is then drawn off and the reſidue, which is the coarſe and unfiniſhed ſubſtance of the Indigo, is taken out and filtered through a cloth gently ſqueezed; the remaining matter after that operation, is put into proper places and dried in the ſun. This matter thus purified, is what they call Indigo. It is ſometimes adulterated by the people, who, to encreaſe the weight, mix it with an earth which has much the appearance of Indigo; and they add thereto ſome oil, that it may float on water.

THE ſtem of the plant which is left ſtanding in the fields, ſprout out the next year and produces an Indigo as good, if not better than the *Gingey*, or wild Indigo.

THE author of the *Amboyna herbal* adds: "I have learnt from the Chineſe another "manner of making Indigo, of which the following is the proceſs."

CHINA.

Second extract from the Amboyna Herbal.

THEY take the branches and leaves of the green herb; ſome even add the ſtem and put them into a vat or a ſtrong butt, with a ſufficient quantity of water to cover the plant entirely. They leave the herb to macerate for twenty-four hours, during which time the water extracts all the colour and thickens to the ſubſtance of mud. They then throw away all the ſtems, branches and leaves, and pour into each veſſel of extract, three or four meaſures, (called *gangtang*) of lime or chunam well ſifted, which they agitate ſtrongly with large ſticks, until a purple ſcum riſes. They then leave the vat to ſettle for twenty-four hours; after which the water is drawn off, and the ſubſtance found at the bottom of the veſſel, expoſed in the ſun to dry. To facilitate the drying, the matter is divided into cakes or ſquares, and when properly dried, makes a merchantable Indigo.

I HAVE alſo had the following information, reſpecting the method of manufacturing at, and about *Agra*: although the proceſſes may appear ſimple, we cannot deny the good quality of the Indigo of that country.

AGRA.

Third Extract from the Amboyna Herbel.

WHEN Indigo has been planted upon a freſh ſoil, and has received the rains of the month of June; and when it has grown to the height of three or four feet, they

cut

cut that and put it into a veſſel which they call a *tank*, and fill that with water. As much weight is put upon the herb as it can poſſibly bear. It is left in this ſtate for ſome days, untill they perceive the water has acquired a ſtrong blue colour. They draw off the extract into another veſſel and agitate it with their hands. They are guided by the ſcum, when they ſhould ſtop the agitation. They then throw in about a pint of oil and keep the veſſel covered untill all the blue parts, which reſemble mud, have ſettled at the bottom. When the water is drawn off, they collect the fecula, ſpread it upon cloth, and put it to dry upon ſandy ground; but whilſt it is yet moiſt, they make it up into clods or balls, and afterwards put it into ſome warm place. This blue matter is then fit for ſale. It is called by them *Notee*, and by the Portugueſe *Barreega*; this Indigo is only the ſecond in point of quality; for after the rains of the ſecond year, have well moiſtened the ground, and that the ſtems of the Indigo left the preceding year, have ſprouted, the young branches being cut and treated as the former, they produce an Indigo of the firſt quality, which the people of the country call *Sjeree*, and the Portugueze *Cabeça*.

The third year they make another, and the laſt crop of the young ſhoots, they treat it in the ſame manner as the two former crops; but the Indigo it produces is of the worſt quality; they give it the name of *Saſſala*, and the Portugueſe, *Peé*. To diſtinguiſh the difference of theſe three kinds, it muſt be remarked that the *Sjeree* or [a] *Cabeça* is of a very fine blue colour; the ſubſtance of it is tender; it floats on the water: put upon hot coals it is of a fine violet colour, and when burnt, leaves little aſhes. The *Notee* or [b] *Bareega*, is of a colour inclining to red, if examined in the ſun. The *Saſſala* or [c] *Peé*, is a very hard ſubſtance and has a dull colour.

a Cabeça, means the head. b Barreega, the belly. c Peé, the foot.

ARTICLE

ARTICLE FIFTH.

Deſcription of the Culture and Manipulation of Indigo, by FRANCIS PELSART.

IN the Eaſt Indies they ſow their Indigo in the month of June, the ſeaſon when it begins to rain, and they employ fifteen pounds of ſeed for every biggah of ground. The Indigo grows to the height of three or four feet, when the ſeaſon has been a favourable one. They get in readineſs and cut it in September or October.

IF you delay too long to make the crop, the cold weather ſets in; the Indigo plant is not able to bear cold, therefore, changes colour, and the paſte it then produces is without luſtre and of a brown hue. The herb is cut at about four inches from the ground, and the production of one biggah is put into one vat. They leave the herb to macerate, for the ſpace of ſeventeen hours; after that time they draw off the water into a ciſtern of about thirty-two feet circumference, and ſix feet deep; two or three men, who are within, agitate it, both with their feet and hands, and by this movement cauſe it to change colour in ſo much, that it becomes of a dark blue. They leave it afterward to depoſe for ſixteen hours. During that time the thick matter ſinks into a hole in the form of a bell reverſed, made at the bottom of the ciſtern. They draw off the water, and take out the Indigo which they ſpread upon cloths until it is dry.—This hole is called a *well*, and all they collect from each *well* is put into earthen pots, which they cloſe very carefully for fear, the air or the wind that might come upon it, ſhould dry it up.—At *Mewat*, a place dependant upon *Agra*, the Indigo is oily and of no great value. You generally find ſand mixed with it. They do not make it in the manner above deſcribed, but as it is made at *Sarqueſſe*, where they pound the leaves (as we have before obſerved). In the villages dependant or *Bayana*, they uſe ſalt

water, which renders the Indigo much harder. It happens ſometimes, that, of two ciſterns or vats of herb, from the ſame ground the one, macerated in ſalt, and the other in ſweet water; that the produce from the ſalt water, will be much brighter, and ſell dearer, than that which has been prepared in the ſweet water.

THE Indians of *Guzzerat* and *Cambay*, after having cut their Indigo, dry and threſh it to get off the leaves, which they grind into powder. They then put the powder into a ſufficient quantity of water, to infuſe for twenty-four hours, ſo that the diſſolution can filter through a cloth. The liquor thus filtered is left to ſettle until the ſediment is well depoſed. The water is drawn off, and the ſediment put to dry on cloths ſtretched out upon fine and very dry ſand, and in the ſhade. When the matter has acquired a certain conſiſtence, they form cakes of it, rather thin, which they completely dry upon boards, ſheltered from the ſun. By this method of preparing Indigo, it produces a merchandize of ſuperior quality. As to what adheres to the filtering cloths they never ſell it to foreign merchants; but the people of the country, make uſe of it to dye their own coarſe cloths.

IN ſome places they prepare the India *paſtel* in the following manner: they dry and reduce the leaves of Indigo into powder, as abovementioned; they then moiſten that powder ſo as to make a paſte which they can immediately dry: but as it is far from acquiring all the beauty it ought, they then grind it down again, and moiſten it as before; make it up into freſh cakes, and ſo continue to repeat this proceſs untill it has acquired the requiſite beauty and brightneſs, and that the quality proves good.

ARTICLE

ARTICLE SIXTH.

*Deſcription of the Culture and Manufacture of Indigo at Carolina, by WILLIAM BURKE.**

INDIGO is a matter obtained from a plant of the ſame name, which is probably ſo called from India, where it was firſt cultivated, and from whence for a conſiderable time, all the Indigo came, that was conſumed in Europe.

THEY cultivate three ſorts of Indigo in Carolina, and each of them require a different ſoil, namely, that of *France* or *Hiſpaniola* ſhoots very long ſprouts and requires a rich ſoil; for this reaſon however excellent of its kind, they cultivate very little in the maritime provinces of Carolina, which are of a ſandy ſoil. But there is no country in the world where finer ſoils are to be found than thoſe at about one hundred miles from the ſea-ſide. Another reaſon which oppoſes the cultivation and ſtops the growth of it, is, that it cannot reſiſt the cold of Carolina.

THE ſecond ſort, namely *the falſe Guatimala or true Bahama*, ſupports the cold much better, becauſe the plant is ſtout and more vigorous, and beſides it is abundant. It grows upon the worſt ground, and therefore, is more cultivated than the firſt, although the produce is inferior in point of colour.

THE third is the *wild Indigo* which being natural to the country, anſwers the views of the cultivator better, as much on account of the duration of the plant, and the eaſe of cultivating it, as that of the quantity of the produce. Opinions are yet divided upon the variety of its qualities, and it is not well known whether it proceeds from the nature of the plant, from the temperature of the ſeaſons, which have a great influence upon

* Hiſtory of the European Colonies.

the perfection of this commodity, or from the manner in which they prepare it. The author gives no deſcription of theſe plants. We will do our beſt to deſcribe them in a future chapter.

They commonly plant Indigo after the firſt rains which ſucceed the vernal equinox (or about the month of April.) They plant the ſeeds in ſmall furrows about eighteen or twenty inches diſtant from each other. If the weather has been favourable, the plant will be fit to cut in the beginning of July. A ſecond crop is made at the end of Auguſt; and when the autumn is temperate another crop is had at about the end of September. The lands muſt be weeded daily, all the vermine deſtroyed, and no care of the plantation neglected, in other reſpects: for upon theſe attentions, the ſpeedy vegetation of your plants, and the good quality of your Indigo entirely depend. Twenty negroes are enough to take care of a tract of fifty acres of ground, and to carry on the proceſs of the manufacture; and beſides, have time enough to cultivate and provide for their own ſubſiſtence, and that of their maſter.* When the ground is good every acre gives from ſixty to ſeventy lbs. of Indigo, which is worth at a medium price from forty to fifty pounds ſterling. They cut the plant the moment it begins to bloſſom; but after it is cut, you muſt take care not to ſqueeze nor jumble it when carrying to the place where it is to ſteep, becauſe a great part of the beauty of Indigo depends upon the *down* attached to the leaves.

The preparations and neceſſary buildings for a manufactory of Indigo, are conſide-

* In this country where daily labour is ſo cheap, how much more profitable muſt it be to the manufacturer: he has not the heavy expences of negroes to look to. In the weſt Indies and America, the proprietor of a plantation is obliged to divide the time of his negroes.—Firſt, the neceſſary time of labour for the manufactures; ſecondly, for the nouriſhment of his ſlaves; and laſtly, for his own houſe conſumption. His other expences for his men are heavy. In India a ſmall monthly or daily pay, and an eye had over the labourer, is all the trouble for the ſame purpoſes.

rable,

rable, but in *Carolina*, they are not very expenſive; they conſiſt of a certain number of pumps and vats made of Cypreſs wood; which is very common and cheap in the country. After having cut the Indigo, they put it into a vat of about twelve or fourteen feet long and broad, and four feet deep, the herb which is to macerate is not above fifteen inches high in the vat; they then fill the vat with water; at the expiration of twelve or ſixteen hours, according to the weather; the indigo begins to ferment, ſwells, riſes and inſenſibly heats. They then keep it down by pieces of wood put acroſs the vat, to prevent the herb from riſing too high, and mark with a nail the line of its higheſt encreaſe. When it begins to deſcend below that line, they judge that the fermentation is at its fulleſt degree, and that it begins to diminiſh. They then open the plug and draw off the extract into another vat called the *battery*. The herb which remains in the firſt vat ſerves to manure the land, and is very excellent for that purpoſe. They continue filling the *ſteeping vat* with freſh herb until all is cut.

After having drawn off the water impregnated with the particles of the Indigo, into the *battery*, they make uſe of a kind of bucket without bottom, fixed to a long haft, with which they ſtir and agitate it; continuing to do ſo until it heats, froths, ferments and riſes above the borders of the vat. To leſſen the violence of this fermentation, they throw oil upon the ſcum, as it riſes, which directly makes it fall. After having thus agitated the water for thirty or thirty-five minutes, according to the weather, (for you muſt beat it longer in cold weather,) ſmall grains begin to form.

To diſcover the particles the better, and know if the water had been ſufficiently beat, they put a little of it from time to time upon a plate or in a glaſs; when it appears in a proper ſtate, lime or chunam water that has been already prepared in another vat, is poured into it, and then the whole is gently agitated to facilitate the operation. The Indigo forms a more perfect grain; the liquor acquires a reddiſh colour: it becomes

troubled and muddy, and they leave it ſo to ſettle. They then draw off the cleareſt parts into different other veſſels, from whence they take it when clear, leaving only the ſediment which they put into cloths; theſe are hung up for ſome time, until the water is entirely drained; to complete the drying of this ſediment, it is taken out from the cloths or bags with a ſpattle made of a porous wood, and put to harden upon planks of wood of the ſame nature, expoſing it frequently in the ſun both morning and afternoon, for a little while each time. They then put it into caſes which are alſo expoſed to the ſun with the ſame precaution, until the operation is finiſhed and that the Indigo is well dried. It requires much attention and addreſs in every part of this proceſs, otherwiſe you riſk loſing the whole. The water ſhould not be left too long nor too ſhort a time, either in the *ſteeping* or *battery vat*: the extract muſt be beat no longer than what is neceſſary, and care taken when drying the ſediment neither to be deficient in, nor exceed it. It is by experience alone that the manufacturer will acquire a knowledge of theſe points, and of the conſequence they are towards the perfect execution of this art.

THERE is perhaps not an article in Carolina upon which ſo much profit is made, as upon Indigo (we may ſay in moſt other countries) and that requires leſs expence. The climate is ſo fine in the province of Carolina, as to give the inhabitants every advantage of cultivating the plant; the materials for the buildings are exceedingly cheap and plentiful, and if the manufacturers continue as they have began, the produce will be adequate to the ſupply of all the world.

ARTICLE

ARTICLE SEVENTH.

Deſcription of the Culture and of the Preparation of Indigo, taken from the Natural Hiſtory of the Indies. *

INDIGO grows in ſeveral parts of India. The preparation in the countries of *Bayana*, *Indooa* and of *Corſa*, two or three leagues journey from *Agra*, paſſes for the beſt. It grows at *Surat*, *Baroche*, and particularly at *Sarqueſſe* which is two leagues from *Amadabad*; from thence it is that the flat Indigo is had. They manufacture it, and nearly in the ſame manner, in the countries of *Golconda*. Indigo is alſo made in the neighbourhood of *Berampore*, and many other places in Bengal, but all theſe kinds are twenty per cent. cheaper than the Indigo of *Agra*. They plant their ſeeds in the Eaſt Indies after the rainy ſeaſon. The uſual cuſtom of the Indians is to cut the herb three times a year. The firſt crop is when it is two or three feet high, they then cut it to within ſix inches of the ground. This firſt crop is without compariſon better than the other two. The price of the Indigo of the ſecond crop, is leſs than the firſt by ten or twelve per cent. and that of the third about twenty per cent. They make the diſtinction by the colour, after breaking a piece of the cake. The colour of the firſt made Indigo, is of a blueiſh violet, much brighter and lively than that of the two others; the colour of the ſecond is alſo livelier than that of the third. But beſides this difference, which makes a conſiderable one in the price, the Indians alter the weight and quality, by foreign mixtures.

After cutting the plants, they pluck off the leaves and dry them in the ſun. They

* Hiſtoire générale des Voyages.

then

troubled and muddy, and they leave it ſo to ſettle. They then draw off the cleareſt parts into different other veſſels, from whence they take it when clear, leaving only the ſediment which they put into cloths; theſe are hung up for ſome time, until the water is entirely drained; to complete the drying of this ſediment, it is taken out from the cloths or bags with a ſpattle made of a porous wood, and put to harden upon planks of wood of the ſame nature, expoſing it frequently in the ſun both morning and afternoon, for a little while each time. They then put it into caſes which are alſo expoſed to the ſun with the ſame precaution, until the operation is finiſhed and that the Indigo is well dried. It requires much attention and addreſs in every part of this proceſs, otherwiſe you riſk loſing the whole. The water ſhould not be left too long nor too ſhort a time, either in the *ſteeping* or *battery vat*: the extract muſt be beat no longer than what is neceſſary, and care taken when drying the ſediment neither to be deficient in, nor exceed it. It is by experience alone that the manufacturer will acquire a knowledge of theſe points, and of the conſequence they are towards the perfect execution of this art.

THERE is perhaps not an article in Carolina upon which ſo much profit is made, as upon Indigo (we may ſay in moſt other countries) and that requires leſs expence. The climate is ſo fine in the province of Carolina, as to give the inhabitants every advantage of cultivating the plant; the materials for the buildings are exceedingly cheap and plentiful, and if the manufacturers continue as they have began, the produce will be adequate to the ſupply of all the world.

ARTICLE

ARTICLE SEVENTH.

Deſcription of the Culture and of the Preparation of Indigo, taken from the Natural Hiſtory of the Indies. *

INDIGO grows in ſeveral parts of India. The preparation in the countries of *Bayana*, *Indooa* and of *Corſa*, two or three leagues journey from *Agra*, paſſes for the beſt. It grows at *Surat*, *Baroche*, and particularly at *Sarqueſſe* which is two leagues from *Amadabad*; from thence it is that the flat Indigo is had. They manufacture it, and nearly in the ſame manner, in the countries of *Golconda*. Indigo is alſo made in the neighbourhood of *Berampore*, and many other places in Bengal, but all theſe kinds are twenty per cent. cheaper than the Indigo of *Agra*. They plant their ſeeds in the Eaſt Indies after the rainy ſeaſon. The uſual cuſtom of the Indians is to cut the herb three times a year. The firſt crop is when it is two or three feet high, they then cut it to within ſix inches of the ground. This firſt crop is without compariſon better than the other two. The price of the Indigo of the ſecond crop, is leſs than the firſt by ten or twelve per cent. and that of the third about twenty per cent. They make the diſtinction by the colour, after breaking a piece of the cake. The colour of the firſt made Indigo, is of a blueiſh violet, much brighter and lively than that of the two others; the colour of the ſecond is alſo livelier than that of the third. But beſides this difference, which makes a conſiderable one in the price, the Indians alter the weight and quality, by foreign mixtures.

After cutting the plants, they pluck off the leaves and dry them in the ſun. They

* Hiſtoire générale des Voyages.

then

then throw it into vats of maſon work, built ſo compact that they appear as one piece of marble. Theſe vats are commonly of eighty or one hundred paces circumference. After having half filled them with brackiſh or ſalt water, they fill the other half with the dry leaves, which they frequently ſtir till they are reduced to a thick ſubſtance. They then leave it to ſettle for a few days; and when the ſediment is ſufficiently ſettled, and the water above it appears clear, they open the plugs, purpoſely contrived all round the baſon or vat, and let it out. They then fill baſkets made for the purpoſe, with this ſediment, each workman takes a baſket, and makes up the paſte in the form and of the ſize of half an egg, cut in two, length way.

The Indigo of *Amadabad* is in ſmall flat cakes. As the duties are collected upon the weight, the merchants in that country, who ſtudy their intereſts, by avoiding a uſeleſs expence, are careful to have it all ſifted before they tranſport *Aſia* Indigo to *Europe*; by this means they get off the duſt or flour which is attached to it. This duſt is a profit to them; for it is uſed in dyes, and the people of the country always buy it. The people employed in this operation ought to take every precaution. While they are ſifting the Indigo, they cover their faces with a cloth that has only two ſmall apertures oppoſite the eyes, and are careful to hold their breath as much as poſſible. They ought to drink milk every half hour, and even theſe precautions do not prevent thoſe who have been employed at this work for eight or ten days from ſpitting blue for ſome time after. It has even been obſerved, that if an egg is put near the ſifters in the morning, that when broken at night, the inſide is quite blue. As ſoon as they take the paſte from the baſkets, previouſly dipping the finger in oil, and that it is made up into cakes, they expoſe them to the ſun to dry. The merchants who buy the Indigo, always burn ſome pieces, to aſſure themſelves that there is no ſand in it. The Indigo is reduced to aſhes, and the ſand remains entire. Thoſe who are in want of ſeeds for planting, leave ſome ſtocks ſtanding the ſecond year. When

the

the cod is ripe, they cut the plants, dry and gather the ſeeds. If the ground has ſerved three years, they leave it fallow for one year, before they plant upon it again.

ARTICLE EIGHTH.

Of the Manufacture of Indigo in Africa. *

THE negroes of *Senegal* call this plant *Quangue*; their manner of working it is very ſimple: they pluck off the leaves from the top of the branches; they pound and reduce it to a fine paſte, of which they make ſmall cakes and dry them in the ſhade. This is the whole of the preparation, and the ſame is practiſed by moſt of the negroes in Africa.

THE paſtel or *Anir* of *Madagaſcar*, is made in the ſame manner. They take the leaves and the tender branches, which they pound, make cakes of the matter, each of about three pounds weight, and dry them in the ſun. When they make uſe of it, they grind the quantity wanted, and put the powder with ſome water into an earthen pot, and boil it for a certain time; they then leave the colour to cool, and ſoak their cotton or ſilk in it, which when taken out becomes of a beautiful deep blue.

* Voyage de François Cauche, à Madagaſcar, &c.

PATENT OFFICE LIBRARY

CHAPTER X.

Of the different Species and Qualities of Indigo, and of the accidents to which it is liable, from the Plantation of the Seed until the Crop.

INDIGO or *Anil* grows naturally and without cultivation in all the countries ſituated between the tropics, and it is cultivated with ſucceſs in thoſe, which are not above forty degrees from the line; but it rarely ſucceeds although but a little diſtance from thoſe bounds. There are five ſpecies known in our colonies, namely, the *Marcom*, the *Mary*, the *Guatimala*, the *Baſtard*, and the *Franc*.

ALL theſe ſpecies have ſome affinity to each other, and require ſome practice for a new comer, before he can diſtinguiſh the difference at firſt ſight; the laſt two being the the moſt generally cultivated, a geneal idea of all the others may be formed by a brief deſcription of them. The Indigo *Franc* is a ſtrait plant, ſmall, furniſhed with thin branches, which ſpreading out, form a tuft. It grows to about three feet high, and even much higher, when upon good ground, free from weeds and vermin, whereon its principal root ſhoots perpendicularly into the earth. That root and the others which iſſue from it, extend twelve or fifteen inches deep; beſides they are white, round, ligneous, hard and crooked. This plant which in time becomes woody and brittle, ſometimes divides itſelf from the very foot, into ſmall ſtems covered with a ſkin of a greyiſh colour, intermixed with green. Its ſtems as well as the ſtalk are round,

round, this laſt, according to the ſoil, may be half an inch diameter more or leſs. The inſide is white, the branches are provided with ſmaller ſtalks bearing eight pairs of leaves, terminated by a ſingle one at the extremity. The leaves are oval, a little pointed, ſmooth, ſoft to the touch, and very like thoſe of clover (*Lucerne*;) but for the colour, the form, ſize, and arrangement of the leaves upon the ſtalks, no plant reſembles Indigo more than *Goat rue*, called by *Linnæus*, *Galega officinalis*. The foliage of Indigo diffuſes a ſweet ſmell, pretty penetrating, but not pleaſing, nearly the ſame as that of a well dried and well manufactured fecula. The leaf has a taſte almoſt the ſame as the fecula, but with a little ſharp bitterneſs of which the whole plant partakes. The branches fill with ſmall bloſſoms of a very light reddiſh violet colour, and of a faint but agreeable ſmell. Thoſe flowers are leguminous, and each compoſed of five petals. The principal petal is larger and rounder than the others, and deeply indented all round, the inferior ones are ſhorter and terminate in a point with a piſtil in the middle.

To theſe flowers nearly reſembling our furze, but much ſmaller, ſucceed pods of about an inch long and the eighteenth part of an inch in diameter, that are ſtiff and brittle, round, ſeedy, and a little curved. Theſe pods contain five or ſix ſeeds of a cylindric form, and of about the twelfth of an inch in length, ſhining, very hard, and of a browniſh colour. The foliage of this kind abound with more fecula, proportionally, than that of the others, and the grains which compoſe it is much larger. I will not add, that the merchandize produced from the Indigo *Franc*, is neceſſarily finer than that from the *baſtard Indigo*, ; becauſe old practitioners maintain that the moſt brilliant quality, ſuch as, the blue or violet floating Indigo, does not depend upon the ſpecies of the herb, ſince the two in queſtion, ſometimes gives the blue, or violet, ſometimes the *pigeon's neck* or copper colour, &c. but only certain circumſtances eaſier to conjecture than to juſtly define, among the number of which the quality of the land is made to

concur

concur as well, the crop of the herb before it is ripe, the imperfection of the fermentation and of the beating, and it is even added the inſects that gnaw and eat the plants and are put into the vats with them. It appears however that the more or leſs unctuoſity in the foilage, and the manner of drying the fecula, ought greatly to contribute to the lightneſs and beauty of the matter; and it is even to be ſuppoſed that the quantity and the quality of the oil ſprinkled in the battery, comes in for ſome ſhare.

As to the reſt, Indigo *Franc* is eaſy to manufacture; but the ſucceſs of its plantation is very doubtful. The tender and delicate ſtalks are expoſed to many accidents from the moment they begin to ſhoot: the rain, wind, ſun, all ſeem to conſpire to deſtroy them; even the ground upon which it grows ſeems to refuſe it aſſiſtance; if it has been much uſed the plant will linger, and produce but ſtalks that periſh as they appear. One of the principal cauſes of its loſs, is the *ſcorching*; that is, the accident to which it is liable, when after a ſhower of rain, the ſun ſuddenly ſhines, and darts its hot rays upon the ground; the water which has not had time to penetrate, heats ſo much, that the young and weak plant, extremely ſenſible at the root, droops and fades away and is burnt up.

Caterpillars, butterflies, and many other kind of inſects, injure this plant from the moment it begins to ſprout from the ground; the webbs they ſpin on the upper part of the branches cover and deprive them of the refreſhing dews and deſtroy them; and the *Mohaqua*, a large white worm which never comes from under ground, eats the root of the plant: every precaution is taken to prevent theſe injuries.

The *baſtard* Indigo attracts theſe inſects leſs; but it is ſubject in its turn, in the advanced ſeaſon, when the rains and the heats are ſtrong, to ſhed its leaves: whence it

reſults

reſults that you are obliged to cut a great deal more herb to fill a vat, and that the loſs becomes conſiderable to the proprietor.

The *baſtard* Indigo differs from the preceeding kind, particularly in point of ſize; it grows any where, but not ſo tall on poor land: the leaf is longer and narrower than that of the *franc*; not ſo thick, of a much lighter green, and rather whiter underneath; the reverſe of this leaf is covered with a fine down, prickly, but eaſily quitting it, which makes it very troubleſome to the people who carry it. The pods are more curved than thoſe of the *franc*, they are yellow, and the ſeeds black, ſhining, and have, like all the other ſpecies, a ſmall cylindric form. It grows to ſix feet high, and ſometimes much higher. If it is true, as there is hardly any doubt that ſome perſons may have tried and ſucceeded after the plant had acquired a great ſize, and that it had bloſſomed and ſeeded, it is not leſs ſo that it was for want of better, and that the rareneſs as well as the difficulty of the ſucceſs, compared with the uſeleſs experiments repeated by the beſt artiſts, ought to engage them, as much as poſſible, to follow the common uſage of cutting, when the plant is at about three feet high, and juſt begins to bloſſom, the ſweet ſmell of which is very remarkable, and that taking a handful of the leaves and gently ſqueezing them, they are ſtiff enough to reſiſt but crack, and make a little noiſe as though they ſqueaked in the hand. The two laſt remarks upon the bloſſom and the ſqueaking, are equally the ſame with the Indigo franc, at whatever height they may be at the time you try the experiment, and ſerve in general as a guide for cutting the one or the other plant. Yet there are circumſtances when it is neceſſary to advance the cutting, and others when it muſt be retarded. The firſt circumſtance is, when the worms are in ſuch great numbers, that you apprehend they will eat it all before the proper time; but it produces much leſs, and the merchandize, is liable to fail in the junction of the grain, a defect, ſuppoſing you had ſucceeded in the reſt of the preparation, which always leſſens the value of it. The other is, when by too great an abundance of rain, the Indigo has come up all at once, and that there is an appearance of fine weather; be-

cauſe eight days of favourable weather give it a body and removes the difficulties which might occur during the fermentation: without this precaution it might embarraſs the moſt able maſter. You are ſometimes forced on account of exceſſive rains, particularly in the firſt part of the ſeaſon, to throw away a whole crop, either becauſe its grain not having body enough, diſſolves at the ſtroke of the bucket; or becauſe the rains beating upon the Indigo in its ſtate of maturity deprives the plant of its foliage, and leaves nothing but the branches: when without loſs of time the labourers are employed, to cut the herb, in order to advance the ſecond crop.

THE manufacture of the *baſtard* Indigo is rather more difficult than that of the *franc*, and the grain of the fecula is not ſo large; but you are well recompenſed by the advantages which the *franc* has not. Firſt, *baſtard* Indigo grows any where, and in all ſeaſons; ſecondly, it is leſs ſubject to inſects, and reſiſts their attack much longer; even the rains will not hurt it, except by an exceſs. Volume alike of herb, this Indigo produces leſs in each vat, than the *franc*, becauſe its foliage grows upon thick ſtalks which occupy a great deal of uſeleſs ſpace in the vat. But this is compenſated by the extent of the ground and the richneſs of the ſtems, of which they cut one third leſs, for filling a vat. Upon the whole, the one amounts to the other; and as it is very rare that the *baſtard* Indigo periſhes in the beginning, they always plant it without any regard to the difficulty of the manufacture, above all in old grounds; reſerving the new for the Indigo *franc*: it is very delicate when upon the point of maturity, and ſhould then be examined with care, ſo as not to let the ſeeds knit; for otherwiſe, it is very difficult to make; and although the artiſt is able enough thereafter to attain his end, it produces ſo little, unleſs it is in very hot weather, that the trouble exceeds the profit. But if you are attentive to cut it in time, and take care both of the fermentation and the beating, it will produce a beautiful Indigo.

THE *baſtard* Indigo is very tardy in growth; for which reaſon many prefer the *franc*, when the ſoil permits, becauſe it can be cut in two months, ſometimes ſix weeks. As

to

to the *baſtard*, it requires more than three months; notwithſtanding that, they ſometimes mix one with the other, when the arrangement of the plantations, or of the crops admit of it; the young ſhoots of the *baſtard* Indigo having that in common with the *franc*, that it ſprouts as quick as this, and ſix weeks after, they cut and put them together, as though the two ſpecies were one. This mixture produces a firm grain and of a good ſize, which aids the artiſt, and procures him the means of conducting the fermentation and the beating to their juſt degree.

THE inhabitants of St. Domingo, only work upon the plants above deſcribed, looking upon the others of a different name, as degenerated plants, from one or the other of theſe two ſpecies.

THE *Guatimala*, perfectly reſembles the *baſtard*, being only diſtinguiſhable by the pods, and the ſeeds which are of a browniſh colour. It is very difficult to make, and produces much leſs than the *baſtard*, and therefore is ſeldom uſed, although it is found growing among the other plants, from which it would be almoſt impoſſible to ſeparate them.

THE *maroon*, or wild Indigo, grows in the *Savannahs* or uncultivated lands; it reſembles a ſmall ſhrub of which the ſhort and tufted ſtock is very thick, in compariſon with the others, which are ſeldom more than the third of an inch in diameter at the bottom of the beſt nouriſhed ſtock, the common being much ſmaller; the branches of the *maroon* often adhere to the very root, the leaf is rounder and ſmaller than the *franc*, but very thin: and therefore, it is conſidered as unfit for trial, and unprofitable in the end.

THE *mary* Indigo reſembles the *franc* in its leaf, excepting that it has leſs ſubſtance; it is rarely found. Some perſons have advanced that it produces a great deal, but we have no proof of it, for we have not met with or heard of any who have made Indigo from this plant.

CHAP.

PATENT OFFICE LIBRARY

CHAPTER XI.

Extract from the Dictionary of Commerce upon the judgment of different ſorts of Indigo, and the Trade carried on with it. Vol. 3. Page 618.

By PROFESSOR LUDOVICI.

FROM all that has been ſaid hitherto upon the preparation of Indigo, we may conclude, that whatever method is taken to make it, it is nothing more than a ſediment got from the plant of that name by the means of water, and precipated by frequently beating it. What is ſtill more ſurpriſing, although Indigo has been made for ſuch a length of time, and that a greater quantity is made in our days, no perſon has found out the ſecret of manufacturing this merchandize, certain of having it of the beſt quality. The moſt ſkilful artiſts miſtake; ſometimes, becauſe they have made the plant ferment either too much or too little; ſometimes, becauſe they have over agitated the water in the ſecond vat, or perhaps not enough. In the firſt caſe the grain of the Indigo already formed, diſſolves again; in the ſecond, the grain which was not entirely formed, remains floating in the water inſtead of precipitating to the bottom of the vat, and is conſequently loſt when the water is drawn off. Indigo is made in different parts of the Eaſt and Weſt Indies, as alſo in the iſland of Madagaſcar, and upon the coaſts of Africa, where the *Anil* is known by the name of *Bangero*.

IN the Eaſt, Indigo is manufactured in ſeveral of the Mogul ſtates, in the kingdoms of

of Bengal and Golgonda. The Dutch make it at the iſland of Java. On the continent of the Weſt Indies they make it principally at Guatimala, and beſides in the iſlands particularly St. Domingo, Jamaica, Curaçao. In ſhort they alſo get it from ſome of the Caribee iſlands.

SHOULD an enquiry be made into the reſpective qualities of theſe diverſe ſorts of Indigo, we might anſwer that thoſe which come from the Eaſt are finer and better than thoſe of the Weſt Indies. What has contributed to eſtabliſh this opinion is, that the form which they give it in the Manufacture (approaching that of an egg, except at Sarqueſſe, where it is flat), obliges the merchants who tranſport it to Europe, to have it pounded very ſmall, in order to be able to pack up a much greater quantity. In conſequence of which the grain appears much finer, and the colour of a deep hue. Beſides, the price of that kind of Indigo is much dearer, which added to the general prejudice that every thing which is dear muſt neceſſarily be better, have ſtrengthened this opinion. The Indigo called *Sirches*, *Sarqueſſe*, *Sarquiſſe*, *Xerquies or Cirquey*, from a village ſituated near Amadabad, the capital of Guzerat, is eſteemed the beſt of all others in quality. That which is made near Biana, Indoua, Corſa, near Agra, and even at Agra is nothing inferior to the firſt. The Indigo from Golconda is alſo much eſteemed. That from Bengal is the leaſt eſteemed of all thoſe which come from the Eaſt Indies (which the Dutch uſed to bring from Berhampore.) The Indigo of Java is as fine as any other kind; and many prefer it even to that of Sarqueſſe.

AT preſent the greateſt part of the Indigo is brought from Spain, France, England, Portugal and Holland, becauſe thoſe powers have poſſeſſions in Aſia and America, where they make that merchandize, or have the advantage of purchaſing it at the firſt hand. The Dutch alone uſed to bring to Europe five or ſix hundred quintals, the moſt of which was ſold at Moſcow and in Germany. At Amſterdam, they ſell ſix ſorts of Indigo, namely, the *Sarqueſſe*, *Guatimala*, *Jamaica*, *Java*, *St. Domingo* and *Laura*.

THE price of theſe kinds of Indigo riſes and falls alternatively. It would therefore be impoſſible to fix any, ſince the quality of the merchandize is ſolely attended to.

IN purchaſing Indigo you muſt above all things pay attention to the qualities. *Firſt*, chooſe the flat pieces, of a middling thickneſs. *Second*, let it be neither too hard nor too ſoft; but of a moderate firmneſs. *Third*, it ſhould take fire eaſily. *Fourth*, it muſt be of a fine deep blue, lively and brilliant without; and within ſtill more beautiful, ſtrewed with ſilvery ſpots or ſpangles, it looks reddiſh when tried by rubbing it upon the nail. *Fifth*, above all Indigo ſhould be light, it ſhould float upon the water, the more it inclines to ſink, the more it is to be ſuſpected that there has been ſome foreign matter mixt with it. If it is found two heavy in proportion to the quality, it ſhould be examined with care.

As this merchandize is dear, it is of importance that the purchaſer ſhould be informed of the frauds that are practiſed to encreaſe the profits. The firſt is that, of beating the plant too much when in the *ſteeping vat*, in order that the leaves and the ſkin may mix in with the paſte. The ſecond fraud is that of mixing aſhes, earth, ſand, and powder of ſlates with it. They throw theſe foreign matters into the *battery* and ſtir them well together, with the Indigo, ſo that the mixture is not perceived. This trick is eaſier done with Indigo in powder, than with the cakes, with which theſe bodies never perfectly unite, but will always form ſmall ſeparate layers, eaſily diſcovered by breaking a piece of the matter. The firſt fraud is diſcovered by the colour, which is blackiſh, and by the weight, conſiderably encreaſed. To diſcover the ſecond, you muſt put a piece of Indigo into water to diſſolve, if it is pure it entirely diſſolves; but if not, the foreign matter ſinks to the bottom of the vaſe. You may alſo burn a piece of Indigo; if it is pure it entirely conſumes, but otherwiſe the mixture abovementioned will remain.

INDIGO ſerves painters to make the blue colour; or mixt with orpiment to make the green. The dyers employ them for the ſame purpoſes. The police regulations of the Holy Roman Empire in the year 1577, declare Indigo to be a colour hurtful, deceitful, corroſive, and diabolical; in conſequence all dyers were prohibited the uſe of it under ſevere pains and penalties. This prohibition was renewed in 1654, by a mandate of the ſtates of the Empire aſſembled at Ratiſbone. The elector of Saxony alſo publiſhed the like prohibition in his ſtates; requiring a ſtrict ſearch to be made, that the offenders might be ſeverely puniſhed. At preſent it is well known that Indigo does not merit thoſe odious qualifications. The regulations publiſhed in France, permit the dyers to employ Indigo with *woad*; provided they mix it with other ingredients alſo; but they prohibited the uſe of it alone, or without being prepared with *aſhes of tartar*, becauſe Indigo alone makes but a falſe colour, not to be rendered good and durable but by mixing it with *woad*, of which the groſſer particles, mixt with earth, unite the particles of Indigo. The Indigo employed for dying ſilk, is the coppered, ſo called from having that hue both without and within the pieces. You could advantageouſly employ, different ſpecies of Indigo for the ſame purpoſe, for example, the blue Indigo, which is lighter, finer, and more beautiful than the coppered.

THEY make a factitious Indigo with rock allum, red wine, flour of * paſtel, ſtarch, urine, and vinegar. They alſo attempted to employ the berries of Laurel, Ivy &c. and myrtle leaves. A manufactory was eſtabliſhed in 1752, at Wolkenſtein, but the attempt did not ſucceed: the colouring particles of that plant are too ſubtile to furniſh a ſolid colour.

* The Indigo made with woad.

CHAP.

PATENT OFFICE LIBRARY

CHAPTER XII.

Obſervations upon the uſe of Mucillages in the Manufacture of Indigo.

WE took notice in our firſt chapter, of ſome expedients that had been imagined, for precipitating the fecula of Indigo; we obſerved that Indigo has always been, and is ſtill made in many countries, where the uſe of mucillages are entirely unknown; and yet the merchandize is ſuperior in quality to that, where recourſe is had to them. Although we are inclined to explode the uſe of mucillages, we muſt not omit to mention the caſes in which they might be uſefullly tried. The firſt is, when the herb has been left too long in fermentation, the artiſt is then obliged to be ſparing of the beating, becauſe the grain is too weak to bear much; the ſecond caſe is when, by an exceſs of beating, the grain which had been formed would diſſolve again, and without this expedient it would be impoſſible to retain it.

In addition to what we have before ſaid upon the ſubject of mucillages, we will obſerve that a decoction of the * *Cannon or Trumpet wood*, † *or the Birch herb alone*, contain a mucillage, which produce the ſame effect: this laſt if maſticated, and your ſaliva is mixed with the extract in the proof cup, you will diſcover the progreſs of the fermentation.

* Cecropiæ pellita.—Limnæus.

† Malva ulmifolia ſemine roſtrato.—Tournof.

BEFORE concluding, we again repeat, that if the whole proceſs has been properly managed, the grain will naturally form and ſink to the bottom, and therefore we do not conceive it of any advantage to recur to artifice; for in any caſe the addition of mucillage offers no real advantage; on the contrary that gluttinous matter which ſinks and carries the fecula along with it, muſt render the Indigo very difficult to drain, and it is not very certain even by taking every precaution to dry it in thin cakes, but that the quality will be greatly altered for the worſe.

PATENT OFFICE LIBRARY

APPENDIX.

NOTE I.—Page 7—lines laſt—Pruſſian alkali.

The author of this work refers us to the chemical Dictionary of Mr. Maquier, for the proceſs for making it, but as we have not been able to meet with that work, we render it as deſcribed by Mr. William Nicholſon.

" The proceſs for making it is as follows: Calcine a mixture of equal parts of vegetable alkali, and dried bullock's blood, until it ceaſes to emit either flame or ſmoke; then raiſe the fire, to give the maſs a low red heat. Throw the matter while red hot into as many quarts of water as there were pounds of the original mixture, and boil it for half an hour. Decant the liquid and waſh the coaly reſidue with more water, till it comes off almoſt inſipid. Add this water to the former, and evaporate the whole by boiling, until it be reduced again to the former number of quarts. This is the lixivium ſanguinis, or Pruſſian alkali, which if added in a proper quantity to a ſolution of iron, precipitates it partly in the form of calx, and partly in the form of Pruſſian blue. If the marine acid be added to the precipitate, it diſſolves the calciform part, and leaves the Pruſſian blue much purer. Hence it appears that the whole of the alkali, in the uſual method of calcinantion with bullock's blood or other animal ſubſtances, is not ſaturated with the colouring matter, but that the unſaturated part of the alkali precipitates part of the iron in the calciform ſtate; while the other part combining with the colouring matter, falls down in the form of Pruſſian blue."

BRITISH MUSEUM OCT 16 69

NOTE

APPENDIX.

NOTE II.—Page 17.—*Of the combination of blue and yellow in the indigo plant which gives it the green colour.*

"BLUE and yellow compoſe green when blended together. *Hellat* ſuſpects that ſuch a *blue fecula* as is procured from Indigo and Woad is procurable from any other vegetable. He ſuppoſes the natural greens of vegetables to be compounded in like manner of thoſe two colours blue and yellow; and that the blue is often times the moſt permament, ſo as to remain entire after the putrefaction or deſtruction of the yellow. The theory is ſpecious and perhaps juſt. NEUMANN.

UPON this hypotheſis, trials have been made in Europe upon the berries of ivy, laurel, &c. and the leaves of myrtle, as mentioned by *Ludovici*, and although a colour was produced, it was of no value.

HOWEVER we have it from good authority, that the late Lt. Col. Kyd made trials with various wild ſhrubs of this country, and thought them very proper for making Indigo, particularly the leaves of the Moranga tree, which it ſeems produced abundant fecula; but perhaps theſe blue colours would be very unfit for dying, as thoſe mentioned by *Ludovici* on account of the ſubtility of their colouring particles.

NOTE III.—Page 75.—*Wild Indigo*——Page 85.—*Baſtard Indigo.*

"AMORPHA—The wild or Baſtard Indigo, in the LINNÆAN ſyſtem of botany, a genus of plants belonging to the *diadelphia decandria* claſs, of which the characters are: the flowers are of the butterfly kind, having an oval concave ſtandard, but no wings, or keel; this is inſerted between two upper ſegments of the empalement, the germen afterwards becomes a reflexed, moon ſhaped pod, having one cell, in which are lodged two kidney ſhaped ſeeds. We know but one ſpecies of this genus.

"THIS

APPENDIX.

" THIS ſhrub grows naturally in *Carolina*, where formerly the inhabitants made a coarſe ſort of Indigo from the young ſhoots, which occaſioned their giving it the title of *baſtard* Indigo."

We have introduced the above two paragrahs only on account of their differing greatly from the deſcriptions of Mr. Burke, and Mr. Beauvar's de Roſeau.

23. 6. 13.

BRITISH MUSEUM 16 69 OCT